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LILLJA (J. L. W.). **Tekniska Föreningens i Finland träkonserveringsförsök under åren 1897–1943.** [Wood preservation experiments of the technical societies in Finland during the years 1897 to 1943.]—*Tek. Fören. Finl. Förh.*, lxvii, 3, pp. 62–73, 1947.

The following wood preservatives were tested during the period under review on spruce and pine beams, planks, and boards under different environmental conditions: zinc chloride solution 2° and 4° Beaumé at 15° C., creosote tar, home-produced wood tar, a mixture of equal parts of home-produced wood tar and tar oil, tar oil, and a 'prepared wood tar' (commercial) as impregnating agents, and carbolineum Avenarius, creosote oil, creosote tar, arbovit oil, tar oil, 'prepared wood tar', ordinary wood varnish (boiled linseed oil and yellow ochre), zinc chloride solution (2° Beaumé at 15°), a commercial carbolineum, and Swedish carbolineum as coatings. Samples of the various treatments were examined in 1902, 1903, 1905, 1911, 1913, 1918, 1926, 1942, and 1943. Impregnation was found to confer a much higher degree of protection from decay than coating, especially on pine, creosote and home-produced wood tar being the best of the preparations tested for this purpose. Good results were also obtained with the mixture of wood tar and tar oil, tar oil alone, and 'prepared wood tar' while Swedish carbolineum proved exceptionally efficient as a coating. Two commercial carbolineums and wood varnish were rated as moderately effective. No difference was apparent between the air- and steam-dried samples.

MCELHANNEY (T. A.). **Forest products research in Canada.**—15 pp., Canada Dominion Forestry Service, 1947.

In this paper, presented to the Fifth British Empire Forestry Conference, held in Great Britain in 1947, the author reviews the research on forest products carried out at the laboratories in Ottawa and Vancouver, and at the Pulp and Paper Research Institute, Montreal.

Wood preservatives, to be effective, must poison the wood substance by slowly feeding toxic material to the moisture in the wood, so gradually depleting the toxic reserve. Accelerated laboratory tests have not yet been devised for measuring the balance between toxicity and permanence, so that the life of the treated timber in service has to be recorded [*R.A.M.*, xxv, p. 377]. In past years a plentiful supply of durable pole timber of eastern and western cedar [? *Thuja occidentalis* and *T. plicata*, respectively] led to the installation of some 10,000,000 untreated poles. Treatments to arrest decay at the ground-line have been developed, and seven methods were selected for test on eastern white cedar [*T. occidentalis*] pole stubs, which are to be examined after six years under service conditions.

It is now possible to determine by laboratory tests whether a new preservative merits service tests. More use is being made of accelerated tests of the decay of small wood blocks treated with the preservative [ibid., xxv, p. 376].

Plywood panels 24 by 30 in. made of 23 to 33 plies of $\frac{1}{20}$ in. red pine [*Pinus resinosa*] veneer banded with cold-press urea glue were pressure-treated with creosote at 180° F. without delamination and with complete penetration. Resistance to penetration by the glue line appeared to find compensation in deep penetration along the grain in alternate plies. With plies $\frac{3}{4}$ in. thick or more, resistance to penetration by the glue lines is more serious and streaks of non-durable sapwood inside may not be reached by the preservative. Infection of this untreated sapwood through bolt or nail holes may result in streaks of decay with consequent serious weakening of the timbers.

An extensive collection of fungus cultures developed from spores trapped on agar plates exposed in lumber seasoning yards is under study. Tests are being made of the relative resistance to decay of rock and white elms [*Ulmus thomasi* and *U. americana*], which appear to be similar in this respect. There is some evidence that variations in resistance to decay of test blocks may be due to the interaction of micro-organisms. An attempt is to be made to ascertain whether growth substances used as herbicides exercise an inhibitory effect on wood-destroying fungi.

Studies of the incipient stages of decay in Sitka spruce [*Picea sitchensis*], used for aircraft, showed that rot caused by fungi of the *Trametes serialis* complex [cf. ibid., xxii, p. 415] may extend for more than 3 ft. beyond the observable decay. A study is being made of the rapidity with which certain of these organisms may develop in wood in storage and service conditions.

Filtrates from cultures of wood-destroying fungi, the cultures themselves, and pieces of Sitka spruce inoculated with the same organisms fluoresced when exposed to ultra-violet light. This suggests a possible means of detecting hidden decay.

Studies made to ascertain the reaction of untreated western red cedar shingles to variations in weather conditions, as compared with those fully treated with a standard shingle stain by dipping or by brush-coating over the exposed portion only, demonstrated that surface coatings materially increase the moisture run-off during rain but do not prevent hygroscopic changes in moisture content. The entry of moisture where shingles overlap is a serious cause of decay. Investigations into the effect of different kiln-drying schedules showed that temperatures up to 160° F. do not affect the durability of the shingles, but those dried at higher temperatures are less durable. Shingles dried at higher temperatures and fully treated with a wood preservative or a standard shingle stain displayed very high durability.

The reddish discoloration sometimes found in the heartwood of Douglas fir [*Pseudotsuga taxifolia*] appears to be related solely to the metabolism of the tree.

An investigation of the toxicity to wood-destroying fungi of a preservative containing 8 per cent. copper naphthenate in a gas-oil solvent [ibid., xxv, p. 378] and offered as a substitute for creosote gave a killing point between 0·4 and 0·24 per cent. of copper naphthenate for tests on malt agar, and between 0·36 and 0·32 per cent. for tests on small impregnated wood blocks. Further work is in progress.

WELLNER (C. A.). **Pole blight—a new disease of Western White Pine.**—*Sta. Pap. North. Rocky Mtn For. Range Exp. Sta.*, Missoula, Mont., 8, 3 pp., 2 pl., 1 map, 1947.

Pole blight, a disease attacking western white pine trees [*Pinus monticola*] has been recognized for at least ten years, though its cause has not yet been definitely ascertained. It was first observed in the Coeur d'Alene and Kaniksu (Idaho) National Forests, and since 1941 its spread and seriousness have caused increasing alarm. Known also as the 'unknown disease', the 'Coeur d'Alene disease or malady', 'Strong's disease', and 'X-disease', it is now referred to as pole blight as it appears to attack only pole-size trees 40 to 100 years old. The condition proves fatal in one to ten years. At present it is spreading in five national forests, 70,000 acres being damaged.

The most conspicuous symptom is a yellowing of the foliage of isolated trees or of groups, the chlorosis progressing downwards. This is accompanied by a thinning of the foliage in the upper crown and stunting of needle and leader growth, usually followed by an exudation of resin anywhere along the trunk. This flow comes from cankered areas ranging in length from a few inches to several feet, under which the cambium is dead.

In some trees the top of the crown has died by the time the basal part turns yellow. As a rule diameter growth slows down. It is recommended that a whole-time pathologist should be appointed to study the problem of cause and control.

Wikén (T.). **Examination of extracts from sporophores of Swedish Hymenomycetes for antibiotic activity against Pullularia pullulans (de Bary et Loew) Berkhout.**—Reprinted from *Ark. Bot.*, xxxiii A, 12, 10 pp., 1 fig., 1946.

Lagerberg *et al.* [*R.A.M.*, ix, p. 7] have shown that *Pullularia pullulans* is an important agent of blue stain of timber in Sweden, where it has also been found by Melin and Nannfeldt [ibid., xix, p. 275] to be quasi-ubiquitous in the air and manufacturing water of pulp mills [cf. ibid., xxvi, p. 322], while it may further be isolated from ground wood pulp. Of 57 Hymenomycetes tested in the form of sporophore extracts for antibiotic activity against *P. pullulans* [cf. ibid., xxvi, p. 350], 48 inhibited its growth to a varying extent, the most powerful and persistent antagonism being manifested by *Boletus bovinus* and *Gomphidius glutinosus*. Extracts from these species produced inhibition disks which did not decrease even after more than three days' incubation of the assay plates, indicating that they contain anti-fungal principles affecting not only the conidia or germ-tubes of *P. pullulans* but also the growing hyphae in the marginal zone of the mature mycelium. The antagonism exerted by 21 other species forming measurable inhibition disks outside the cylinders was merely temporary. Several members of this group, notably *Clitocybe clavipes* and *Omphalia maura*, contained both anti-fungal and anti-bacterial (*Staphylococcus aureus*) [loc. cit.] principles.

Clinch (Phyllis E. M.), Loughnane (J. B.), & McKay (R.). **Transmission of a disease resembling virus yellows through the 'seed' of Sugar Beet.**—*Nature, Lond.*, clxi, 4079, pp. 28–29, 1948.

During breeding experiments in 1946, Mr. B. Crombie of the Irish Sugar Company observed in three field crops that about 25 per cent. of plants of a new sugar beet family showed yellowing two to three weeks after singling, the symptoms resembling those of beet yellows virus [*R.A.M.*, xxvi, p. 520]. The parent plants of the family (No. 41) had been selected from good commercial stock in a relatively virus-free district and the cross had been made in 1945 in a pollen-proof cage.

Affected field plants, together with the residual 'seed', were sent to University College, Dublin. Some of the seed was sown in autumn, 1946, and the rest in March, 1947, and when the plants were about 10 in. high and had 10 to 12 foliage leaves, the tips of the two basal leaves of certain plants became tough and light green, turning later to yellow and orange, only the parts round the veins remaining green. Finally the chlorotic areas withered and turned brown and the leaf margins curled upwards. Of the 143 plants grown from the seed 47·5 per cent. showed the disease [ibid., xxii, p. 123].

Experiments showed that the aphid *Myzus persicae* could transmit the disease to healthy sugar beet and spinach. Out of 68 sugar beet and 34 spinach seedlings 85 and 76 per cent., respectively, developed yellows, the first symptoms appearing in the lower leaves three to four weeks after inoculation by the vector. When field plants of commercial beet and mangold showing typical yellows were used as sources of inoculum, symptoms apparently identical with those in family 41 appeared in the test plants. It is presumed that ordinary yellows virus was present

in at least one parent of the family 41 and it penetrated the seed of the progeny.

There are apparently two types of yellows occurring in commercial sugar beet. Certain plants yielded a virus (or virus mixture) which when transferred to test plants produced a clearing or superficial necrosis of the veins of the young leaves, followed by the yellowing symptoms described above.

WENZL (H.). **Die Cercospora-Gefährdung der Rübenbaugebiete Deutschlands. Ein Beitrag zur Darstellung der Abhängigkeit der Pilzkrankheiten von den Klimaverhältnissen.** [The liability to *Cercospora* of the Beet-growing regions of Germany. A contribution to the account of the dependence of fungus diseases on climatic conditions.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, 2, pp. 265–272, 3 graphs. [? 1940. Received November, 1947.]

Beet leaf spot (*Cercospora beticola*) is an outstanding example of a plant disease dependent for its pathogenicity on appropriate humidity and temperature conditions. By an adaptation of Stolze's 'climogram' method [*R.A.M.*, xi, p. 347], involving a consideration of the monthly mean temperatures and precipitation from May to September (the critical time for infection) over a period of years, the author constructed graphs demonstrating the liability to leaf spot outbreaks of the different beet-growing regions of Germany, with comparative references to the situation prevailing in this respect in other countries where the crop is cultivated.

WALKER (J. C.). **Onion diseases and their control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1060, 26 pp., 16 figs., 1947.

In this bulletin, a slightly amplified version of the revised edition published in 1944 [cf. *R.A.M.*, xxiii, p. 469], the author describes the symptoms, causal organisms, and control of the chief onion diseases found in the United States, including those primarily important in the field, those primarily important in storage and transit, and non-parasitic blemishes and maladies. Sections are devoted to farm and handling practices in relation to disease, and a descriptive key is provided to diseases, among which may be mentioned aster yellows virus observed in Idaho and Wisconsin, causing the pedicels to lengthen abnormally and the flowers to become distorted and sterile.

ALLISON (J. C.). **Present status of Soybean diseases.**—*Soybean Dig.*, vii, 11, p. 49, 1947.

An outline is given of the organization and scope of the project for soy-bean disease research started in 1945 by the Division of Forage Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture. The Cornbelt being the major area of soy-bean production, headquarters have been located at Urbana, Illinois, where Dr. W. B. Allington works in close co-operation with the Illinois Agricultural Experiment Station and the Regional Soybean Laboratory. Other centres of investigation have been established in connexion with the mid-western agricultural experiment stations of Ohio, Indiana, Iowa, Missouri, Wisconsin, and Minnesota.

A co-ordinating centre for the next most important region of soy-bean production, the Delta region of Mississippi, Arkansas, and Louisiana, has been established at the Delta Branch Experiment Station, Stoneville, Mississippi, in charge of Dr. H. W. Johnson, with other branches at the Maryland, North Carolina, Georgia, and Louisiana experiment stations [*R.A.M.*, xxvii, p. 6].

The overall co-ordination for the entire soy-bean disease programme is supplied by the author from the national headquarters of the Division of Forage Crops and Diseases at Beltsville, Maryland.

In the absence of an organization such as that described, a serious disease situation might arise at any time. For instance, brown stem rot, first observed in the autumn of 1944, was at first attributed to early frost, but the soy-bean research pathologists soon ascertained its true cause, a parasitic fungus [*Cephalosporium acremonium*: ibid., xxvii, p. 107], and developed measures for its control, notably by means of crop rotation.

LACKEY (C. F.). **Effects of curly top virus strains on extent of injury in root tips of susceptible and resistant Sugar Beets.**—Abs. in *Phytopathology*, xxxvii, 11, p. 844, 1947.

Inoculation experiments were performed on sugar beets with three strains of the [beet] curly top virus, of which the virulent No. 1 was responsible for severe roughening of the veins and foliar distortion on susceptible varieties; No. 2 induced very little stunting and only mild vein rugosity; while No. 6 also caused very mild symptoms on the leaves but was associated with extensive dwarfing and high mortality. The root tips of susceptible varieties infected by strain 1 show marked degeneration and necrosis of the cells surrounding the sieve-tubes [*R.A.M.*, xxv, p. 592], whereas in resistant varieties only an occasional cell is involved. Strain 2 induces only mild degeneration in a few cells in the region of the sieve-tubes, susceptible and resistant varieties being about equally affected. Like strain 1, No. 6 is more injurious to the root tips than to the foliage of susceptible varieties, many other cells besides those near the sieve-tubes sustaining heavy damage. The root tips of resistant varieties suffered similar but milder injury.

DORAN (W. L.). **Fungicides applied in fertilizer for the control of Cabbage clubroot and damping-off.**—Abs. in *Phytopathology*, xxxvii, 11, p. 848, 1947.

Dithane D–14 and Dow seed protectant No. 9 [*R.A.M.*, xxvi, p. 378], mixed with a 5:8:7 commercial fertilizer and distributed over the soil [? in Massachusetts] immediately before sowing at the rate of 15·6 gm. of the mixture per sq. ft., controlled damping-off [*Rhizoctonia* spp., including *Corticium solani* and *Pythium* spp.] better or with less injury than when applied in water just after sowing. Mercurous chloride and other mercury salts (0·15 or 0·20 gm. per sq. ft.) combated club root [*Plasmodiophora brassicae*] more effectively and safely in soils previously given a dressing of hydrated lime (20 gm.) or sodium chloride (10 gm. per sq. ft.) than they did on untreated ground. Similarly, dithane was more toxic to the damping-off fungi in a limed soil. However, all these fungicides as well as fermate, phygon, and zinc mercaptobenzthiazole proved inferior in club root control to tuads (tetramethyl thiuramdisulphide) [ibid., xxiv, p. 268; xxvi, p. 378] at 0·55 gm. per sq. ft., applied in the fertilizer. The compound also gave good control of damping-off [cf. ibid., xxvi, p. 224] and greatly stimulated seedling growth in both limed and unlimed soils.

HENRY (A. W.). **Newer chemical seed treatments for Peas.**—*Pr. Bull. Univ. Alberta*, xxxii, 1, pp. 4–5, 1947.

Comparative field tests carried out at Edmonton, Alberta, in 1944 gave the following results. Perfection peas treated with spergon (2 oz. per bush.) [*R.A.M.*, xxvii, p. 4] showed 67 per cent. emergence and yielded 67 bush. per acre, arasan (2 oz.) 66 and 69, ceresan (1 oz.) 69 and 73, and the untreated control 42 and 59, respectively. Spergon and arasan are recommended as being safer than ceresan. Because all these chemicals are liable to kill legume bacteria on inoculated seeds, it is suggested that either the bacteria be applied to the soil at sowing time or the seed treated with spergon first and the inoculation delayed until four hours before sowing.

Cunningham (H. S.). **Control of downy mildew of Lima Beans on Long Island.**—*Bull. N.J. agric. Exp. Stas.* 723, 19 pp., 4 figs., 1947.

Details are given of comparative spraying and dusting experiments carried out on Long Island from 1940 to 1945, inclusive, on the control of Lima bean [*Phaseolus lunatus*] downy mildew (*Phytophthora phaseoli*) [*R.A.M.*, xxii, p. 291] on the Fordhook variety, both naturally and artificially infected. The disease reached epidemic proportions in 1942 only. A number of fungicides were applied weekly as dusts and sprays and also tested for their effect on the plants in the absence of the disease.

The results showed that all the copper fungicides gave good commercial control of infection, and that there was virtually no difference in fungicidal efficiency between them. Copper fungicides caused no conspicuous pod discoloration or any reduction in yield, but injury in the form of rusty brown spots occurred in transit if the beans were picked and packed when wet. The organic fungicides failed to give commercial control, with the exception of dithane D–14 with zinc sulphate and hydrated lime added, which was as effective as the coppers in one experiment.

Kassanis (B.). **Studies on Dandelion yellow mosaic and other virus diseases of Lettuce.**—*Ann. appl. Biol.*, xxxiv, 3, pp. 412–421, 2 pl., 1947.

Under experimental conditions the first symptoms of dandelion yellow mosaic [*R.A.M.*, xxvi, p. 407] on dandelions were a few isolated bright yellow spots which appeared five to six weeks after infection. A fortnight later the number of spots increased and rings, oak-leaf patterns, and other designs also appeared, imparting the vivid yellow mottle characteristic of the disease. No stunting or deformation of the leaves was noted, and apart from the mottle their growth seemed normal.

On lettuces [ibid., xxiii, p. 373] the symptoms included severe stunting with considerable leaf malformation, particularly in autumn and winter. When the plants were infected as seedlings little further growth took place. Some plants with yellow mottling later developed all the patterns commonly found on infected dandelions.

On outdoor lettuces which had begun to heart severe necrosis generally started in one outside leaf and passed rapidly to the young inner leaves, which eventually rotted as a result of secondary fungal attack. On individual leaves necrosis generally began on one side of the lamina, the midribs twisting as a result of differential growth. If left in the ground some of the plants survived, but only to bolt, the whole inflorescence becoming necrotic; little or no seed was produced.

*Lactuca serriola* and *L. virosa* were infected with dandelion yellow mosaic virus by *Myzus ornatus* and with lettuce mosaic virus by *M. persicae*. On *L. serriola* the first symptom of lettuce mosaic was a vein-clearing of the younger and middle leaves followed by a green mottle similar to that found on cultivated lettuce. The edges of the laminae of the young leaves were curled downwards. In *L. virosa* the initial reaction to lettuce mosaic was strongly marked: the young leaves developed a severe veinal necrosis and the growing point also became affected. Some of the middle leaves produced necrotic veinal reticulations, whereas the lower leaves showed only occasional necrotic spots. The plants later recovered to some extent, but the new growth was pale, and showed symptoms resembling mottling and some necrotic veinal spotting. All of ten plants of *L. serriola* were infected by aphids with dandelion yellow mosaic, developing a green mottle on the youngest leaves, and of ten *L. virosa* plants eight had obvious symptoms, most of the middle leaves developing bright yellow patches, though a few showed shiny spots surrounded by etched rings.

No infections of dandelion were obtained by mechanical inoculation with the yellow mosaic and only three by aphids, whereas lettuce infection was obtained regularly by aphids [ibid., xxv, p. 492] and, provided an abrasive was used, by mechanical inoculation. The aphid *Aulacorthum* [*Macrosiphum*] *solani* transmitted

the yellow mosaic, but not lettuce mosaic. *Nasonovia ribicola*, the common lettuce aphid, became infective only after some hours' feeding on diseased plants, and ceased to be infective an hour later.

Most samples of commercial seed used in these experiments produced seedlings 2 to 4 per cent. of which were infected with lettuce mosaic virus. No evidence was obtained of any seed transmission of the dandelion mosaic virus. Cucumber mosaic virus was isolated from diseased lettuces received at Rothamsted. In tests *M. ornatus* transmitted this virus to lettuce readily.

TOCCHETTO (A.). **Anthracnose do Chuchu.** [Chayote anthracnose.]—*Bol. agron., Pôrto Alegre*, 113–114, pp. 123–124, 2 figs., 1946.

One of the most virulent pathogens of the chayote (*Sechium edule*) in Rio Grande do Sul, Brazil, is *Colletotrichum lagenarium*, the agent of extensive foliar necrosis, which may spread to the base of the petiole and, in damp, low-lying situations, to the branches, arresting the growth of the fruits. In addition to appropriate cultural methods, spraying with 1 per cent. Bordeaux mixture at 20-day intervals is recommended for the control of the disease.

PLAKIDAS (A. G.). **Comments on the temperature relationship of the Cucurbit downy mildew fungus.**—*Plant Dis. Reptr*, xxxi, 11, pp. 422–425, 1947. [Mimeographed.]

The author states that in his experience moisture is the most important factor for the development of the downy mildew of cucurbits (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) [*R.A.M.*, xxiii, p. 423; xxvi, p. 477], and maintains that whereas many other downy mildews are favoured by cool weather this does not apply to the cucurbit downy mildew. In Louisiana it occurs throughout the hot summers and was particularly widespread in 1947 in the Hammond area during the last week of August and the first week in September, when the maximum temperatures ranged from 96° to 101° F. and the minimum from 74° to 77°.

MANNS (T. F.). **The vert-de-gris disease of the cultivated Mushroom occurring in the United States.**—*Plant Dis. Reptr*, xxxi, 11, pp. 417–418, 1947. [Mimeographed.]

For the past three years mushrooms in Pennsylvania have been heavily attacked by a fungus, tentatively identified as *Myceliophthora lutea* [*R.A.M.*, xi, p. 493], of which two forms were observed in the district, one with smooth chlamydospores as described by Costantin *et al.* (*Rev. gén. Bot.*, vi, pp. 289–300, 1894), the other with chlamydospores having spines. In severe cases the pathogen forms a mat just beneath the casing soil and causes losses of 50 to 75 per cent. In the 1947 season the disease occurred in several places in Chester County, Pennsylvania, in Maryland, Ohio, and Illinois.

Preliminary investigations have revealed that the severe form ('mat disease') is primarily a heavy infestation of the casing soil, and such soil should never be used in supplementing composts. Steam heat at 140° F. for three hours does not control the disease. The author found that the injection of a solution of formaldehyde into high-pressure steam boilers at 75 to 100 lb. and the forcing of this steam through the soil or into infested houses has given promising control.

MARTINEZ (A.). **Nota sobre un hongo invasor de los cultivos de Agaricus campestris.** [Note on a fungus invading cultures of *Agaricus campestris*.]—*Rev. argent. Agron.*, xiv, 4, pp. 273–278, 1 pl., 1 fig., 1947.

In June, 1946, mushroom (*Agaricus* [*Psalliota*] *campestris*) beds at Villa Adelina, Buenos Aires, were invaded by *Pseudobalsamia microspora* [*R.A.M.*, xxiii, pp. 87, 425 and next abstract], not hitherto recorded in Argentina. In this connexion Diehl and Lambert's description of the fungus is recapitulated [ibid., x, p. 290], its

biology and economic importance are briefly discussed, and Kligman's recommendations for its control are summarized [ibid., xxiii, p. 425].

Atkins (F. C.) & La Touche (C. J.). **Competition from Pseudobalsamia microspora Diehl and Lambert.**—*Mushroom Dis. Leafl.* 2, 3 pp., 2 figs., 1948.

In this short summary of the salient features of *Pseudobalsamia microspora* [*R.A.M.*, xx, p. 512 and preceding abstract] in cultivated mushroom beds, the authors recommend for prevention, in addition to measures already noted, the use of uncontaminated soil for mixing with the compost or for casing, disinfection of board surfaces with a blowlamp, and soaking of boards and house structure with double-strength fungicide. Beds should be neither too wet nor too tight. Ventilation should be adequate. To control the disease large, infected areas should be separated from the healthy ones by channels and all fruit bodies removed and burned. Great care should be taken in avoiding transfer of mycelium from infected to free areas. Flies, which can spread the disease, should be eliminated.

Venkatarayan (S. V.). **Mosaic disease of Malvastrum coromandelianum Garcke.**—*Curr. Sci.*, xvi, 11, pp. 347–348, 1 fig., 1947.

*Malvastrum coromandelianum*, an introduced weed common along roadsides and in waste places in several parts of India, is affected in Bangalore by a vein-clearing mosaic of the young foliage, accompanied by dwarfing and, in some cases, by a tendency to upward curling of the leaves. Diseased plants are altogether stunted. The condition resembles the vein-clearing mosaic of *Hibiscus esculentus* [*R.A.M.*, xx, p. 242], the A-type of infectious chlorosis [ibid., vii, p. 385] of *Kitaibelia vitifolia*, and tobacco leaf-curl virus.

Mosaic diseases of wild Malvaceae do not appear to have attracted the attention in India demanded by their potential connexion with similar maladies of cultivated plants of the same family, such as cotton and *H. esculentus*. In the case under observation, for instance, *M. coromandelianum* may well serve as a secondary host for the mosaic virus of *H. esculentus*.

Maume (L.) & Dulac (J.). **Sur les valeurs extrêmes des proportions d'azote, d'acide phosphorique et de potasse dans la feuille, en relation avec la santé de la Vigne.** [On the extreme values of the proportions of nitrogen, phosphoric acid, and potassium in the leaf in relation to the health of the Vine.]—*C.R. Acad. Sci., Paris*, ccxxv, 25, pp. 1374–1376, 1947.

In further extensive studies on the health of French vines by the method of foliar diagnosis [*R.A.M.*, xxvi, p. 202] the authors found the following minimum and maximum proportions of nutrients (in percentages of dry matter) at three epochs of the annual vegetative circle, viz., (1) onset of flowering, (2) ripening, (3) harvest. They were as follows: nitrogen at (1) minimum 1·5 maximum 3·9, (2) 1·2 and 3·6, (3) 0·7 and 2·7; phosphoric acid at (1) minimum 0·3 maximum 1·4, (2) 0·2 and 0·9, and (3) 0·12 and 0·6; potash at (1) minimum 0·45 maximum 4·1, (2) 0·3 and 3·3, and (3) 0·2 and 2·6. In general, the specimens containing the minimum percentages of nutrients (especially potash) emanated from unproductive vines, including those suffering from 'brunissure', chlorosis, court-noué, and the like.

Du Plessis (S. J.). **Die voorkoms en bestryding van roetdou op Sultanastokke veroorsaak deur Exosporium sultanae nov. spec.** [The occurrence and control of sooty dew on Sultana Vines caused by *Exosporium sultanae* n. sp.]—*Ann. Univ. Stellenbosch*, Ser. A, xxiv, 5, 32 pp., 17 figs., 1946. [English abstract.]

A leaf blotch disease was reported on Sultana vines in the Kenhardt district of the Cape, whence it has since spread to vineyards of the same variety (the only one affected) at Vredendal Ladismith, and Worcester. The first symptoms appear on

the dorsal leaf surface in the form of dark olive-coloured, velvety to granular, indefinite spots, which on attaining a diameter of about 3 mm. acquire a halo of chlorotic tissue. At this stage the centres become necrotic and are perceptible on the ventral surface as dark brown, irregularly circular spots. Severe infection leads to premature defoliation, with consequent reduction in the fruit yield, debilitation of the shoots, exhaustion, and ultimate death of the vines.

A technical diagnosis is given of the causal organism of the leaf blotch, for which the name *Exosporium sultanae* n. sp. is proposed. Typical circular, pulvinate, applanate to slightly raised sporodochia, 30 to 120 $\mu$ in diameter, are formed mostly on the dorsal surface, on which continuous to quadriseptate, elongate cylindrical or subfusoid, smooth, pale smoky-brown conidia, 10·8 to 61·2 by 5 to 10·1 (average 31·8 by 7·3) $\mu$, are borne acrogenously on erect, elongate clavate, smoky-fuscous, simple, straight or subgeniculate, uni- or biseptate, densely fasciculate conidiophores, 16 to 29·2 by 5 to 7·3 $\mu$.

The fungus makes very poor growth in culture. Sporulation and conidial germination are promoted by exposure to temperatures ranging from 15° to 20° C.

*E. sultanae* overwinters in fallen leaves and attacks the Sultana shoots only under particularly favourable conditions, of which a sufficiently heavy rainfall during the early growing season, especially in October, is the most important. Resistance to the disease was not appreciably strengthened by the application of fertilizers containing nitrogen, potash, phosphate, manure, or lime. The best control has been obtained by three-weekly treatments, using a 'Vulcan' dusting apparatus, with 'lightning' sulphur dust (99 per cent. sulphur) or copper-sulphur dust (capex), consisting of 20 per cent. copper carbonate and 40 per cent. each of ground sulphur and China clay.

Hewitt (W. B.). **The development of Pierce's disease and its occurrence in rogued and unrogued vineyard plots.**—Abs. in *Phytopathology*, xxxvii, 11, p. 844, 1947.

In the San Joaquin Valley [California] the general development and spread of Pierce's disease of the vine [lucerne dwarf virus: *R.A.M.*, xxvi, p. 480] increased with great rapidity after 1934, reaching a climax about 1941. The annual incidence has since declined in comparable proportions. The distribution of the disease in a vineyard, a district, or even throughout the valley fell into three general patterns, viz., (1) irregularly scattered over most of the area; (2) centred in small, localized foci; and (3) concentrated in parts of vineyards adjacent to lucerne or irrigated pastures. The systematic roguing of diseased vines twice each season, once in the spring and again in the autumn, in plots ranging from 10 to 120 acres each, did not significantly influence the occurrence of new cases of lucerne dwarf in comparison with untreated vineyards. There was no apparent effect on the annual incidence of the disease, moreover, in two further 10-acre plots rogued several times each season over a five-year period.

Scherz (W.). **Ein Weg zur Züchtung gegen Plasmopara viticola resistenter Rebenformen durch Auffinden somatischer Mutanten innerhalb der Spezies Vitis vinifera.** [A method of breeding Vine forms resistant to *Plasmopara viticola* through the discovery of somatic mutants within the species *Vitis vinifera*.]—*Züchter*, xv, 10–12, pp. 205–211, 4 figs., 1943.

The 300-ha. group of vineyards in which the author's experiments in breeding for resistance to *Plasmopara viticola* were performed was situated in the Bergzabern district of the Palatinate. In this 'no man's land' between the Maginot Line and the West Wall the course of the war precluded all cultural operations during 1940, resulting in a downy mildew epidemic at the height of the growing season. This in turn prevented the proper ripening of the wood, so that practically 100 per cent. of the overground parts of the stands perished during the following winter. Any

vines reacting otherwise, therefore, must have suffered little or no damage from *P. viticola*, either by reason of their genetic constitution [cf. *R.A.M.*, xii, p. 548] or on account of special environmental conditions during the critical period of 1940. On this assumption the vineyards were systematically searched for such individuals in May, 1941, and 469 of 13 varieties were found in an apparently undamaged condition and just beginning to put out new shoots; of these 193 were successfully propagated at the Müncheberg Vine Breeding Research Institute and inoculated with spore suspensions of *P. viticola* under optimal conditions for the parasite. A considerable proportion of the more susceptible clones had to be discarded, though most were distinctly more resistant than the typical *Vitis vinifera*. Others reacted with medium-sized necrotic lesions, representing class 3 in the Müncheberg scale, where 1 is the most resistant and 5 the most susceptible, while a small percentage fell into class 2. On planting out in 1942 most of these clones maintained their resistance in spite of heavy spontaneous infection. A more or less pronounced tendency to somatic mutation in respect of resistance to downy mildew was shown by the Malvoisie, Green Sylvan, White Riesling, White Burgundy, Bocksbeutel (Würzburg), and Abunduntia varieties, the percentages of which in class 2 were 37·2, 2·3, 2·2, 11·1, 16·7, and 22·4, respectively. Other varieties, e.g., Blue Portuguese, of which 43·8 and 56·2 per cent., respectively, fell into classes 4 and 5, seemed to combine some degree of tolerance with their susceptible reactions, their vital functions remaining essentially unimpaired.

Such highly resistant types as some of the Malvoisie mutants are likely to be of great value in breeding and cultural operations, while the tolerant forms may also be well worth further investigation in this respect. Resistance to *P. viticola* of the order here described has hitherto been totally unknown among European vines, which could only be preserved under the prevailing climatic conditions by repeated treatments with copper-containing fungicides. It is concluded that the representatives of this atypical form of resistance can only have arisen through somatic mutation.

Van der Plank (J. E.). **The relation between the size of plant and the spread of systemic diseases. I. A discussion of ideal cases and a new approach to problems of control.**—*Ann. appl. Biol.*, xxxiv, 3, pp. 376–387, 1947.

After defining a systemic plant disease as one which extends through the entire susceptible portion, the author formulates three theorems on the relation between plant size and spread of infection. These are (1) the spread of an infectious systemic disease increases with the size of the plants, size being appropriately determined and other factors being constant; (2) when a systemic disease enters a crop from some uniform outside source the logarithm of the proportion of healthy plants is directly proportional to the size of the plants, other factors being constant; as an approximation the proportion of infected plants is directly proportional to their size if the proportion is small: a corollary to this is that if the proportion of infected plants is small and if size is inversely proportional to density of planting, the number of infected plants per unit area will be approximately constant, factors other than size and number remaining constant; and (3) when a systemic disease spreads within a crop, the rate of infection is proportional to the size of the healthy plants, other factors being constant. If factors other than size, time, and proportion of infected plants are constant the expression for the rate is $\frac{dx}{dt} = ks(1-x)$, or $\frac{dx}{dt} = ks(1-x)x$, or $\frac{dx}{dt} = k\,s(1-x)\,f(s, t, x)$, where $x$ and $1-x$ are, respectively, the proportions of infected and healthy plants, $s$ is the size, and $k$ is a constant. The second part of this theorem is tentative.

In these theorems a disease is taken to be systemic if a single effective transmission produces maximum infection of the plants, the word 'plant' including in special circumstances parts of plants. Size (in the first theorem) refers to that portion of the plant which can receive infection. For quantitative relations size is taken to be proportional to the probability that the plant receives infection at any instant from a uniform source in appropriate circumstances. In the special case when disease is introduced into a crop by insects or other vectors, size is taken to be the catchment zone of the plant for the insects, and is usually inversely proportional to the number of plants per unit area.

Discussing reduction of size in relation to control the author states that numerical calculations show that control of a systemic disease by reducing size is most difficult when the percentage of infection is high. Reduction of infection is then far from proportional to reduction in size. However, control is possible with high percentages of infection, as when a systemic disease affects plants when they are small, if they are planted thickly, and a large population is maintained until thinning is required [cf. *R.A.M.*, xxv, p. 188; xxvi, p. 257].

In the case of systemic diseases attacking mature plants, it is a condition of control that the percentage of disease must be reasonably low. The chief advantage of the method is that it applies simultaneously to all systemic diseases, and when a crop is subject to many of them it gives a measure of insurance against all, each independently of the others. In South Africa experiments are in progress to determine the effect of replacing tomato plants bearing three or four main branches by three or four plants each pruned to a single stem. Thus only the size is changed. Another project is to raise nucellar (apomictic) citrus seedlings in an attempt to throw off viruses without losing the advantages of vegetative propagation, bud these on to dwarfing (*Poncirus trifoliata*) stock, and plant out at the rate of thousands per acre or maintain as dwarfs in pots quarantined in a glasshouse. These plants would then provide buds for ordinary stocks planted at the usual spacings.

Mathematical considerations apart, the control of systemic disease by reducing size is a step in the same direction as controlling disease by localizing the lesions. If this is not practicable, the next step is to limit the disease as much as possible by reducing the size of the plant.

Pirie (N. W.). **The state of viruses in the infected cell.**—*Cold Spr. Harb. Symp. quant. Biol.*, xi, pp. 184–192, [? 1947].

In this address (given at the Cold Spring Harbor symposium on quantitative biology [? in 1947]) on the properties of viruses as they exist in the cell, the author gives three reasons why it is uncertain whether a virus extract has the same properties as the intracellular virus. These are (*a*) the preparation may be contaminated with host constituents having properties superficially so similar to those of the virus that the present methods of fractionation fail to separate them, (*b*) each virus particle may be associated as a complex with constitutents of the host not essential for its activity, and (*c*) fractionation may alter some of the properties of the virus without altering its infectivity. The evidence for the existence of complexes with components of the host tissue is reviewed and the alterations which may occur during isolation are discussed. The author concludes that the visible structures found in infected cells have properties that suggest that part of the virus is present in them in the form of a complex, as otherwise they would not stay out of solution. This interpretation depends on a knowledge of the intrinsic properties of the virus, and there is much evidence to suggest that these are not necessarily the same in the cell and in extracts. There can be no question that a study of the properties of the purified viruses imposes certain limitations on the range of properties that can be legitimately attributed to the same viruses in the cell.

From a utilitarian point of view the accumulation of evidence about the association of virus particles with one another and with other cell constituents is important, since the course followed by an infection may depend as much on these associations as on the rate at which virus can be synthesized in the cell. It may be supposed that some of the effects of the nutritional state of the host, and of the introduction of simple substances into the host, on the manifestations of a virus disease may result from the changing chemical environment affecting the state of attachment of the virus.

The stability of a virus and presumably the likelihood that it will undergo variation or mutation must depend on its state of chemical combination between the time of its synthesis and the establishment of infection in another cell.

Zogg (H.) & Salzmann (R.). **Pflanzenschutz. *Ex* Bericht über die Tätigkeit der Eidg. Landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon für die Jahre 1942–1946.** [Plant protection. Report on the work of the Federal Agricultural Experiment Station, Zürich-Oerlikon for the years 1942 to 1946.]—*Annu. agric. Suisse*, xlviii, 2, pp. 214–224, 1947.

The wide expansion of agriculture in the Zürich district of Switzerland during the period under review [cf. *R.A.M.*, xxv, p. 25] was accompanied by an intensification of plant diseases and pests. Cereal black rust [*Puccinia graminis*], for instance, assumed a devastating form in a region of the Lower Rhine Valley where barberries grow in profusion, since their eradication is impracticable locally. Wheat brown rust [*P. triticina*] was responsible for exceptionally heavy losses in 1946 in the lower Rhine Valley of St. Gall and the Linth plateau. Foot rots (*Cercosporella herpotrichoides*, *Ophiobolus graminis*, and *Fusarium* spp.) were particularly virulent on cereals in 1945 and 1946: in the latter year up to 90 per cent. infection was observed on the second crop of wheat following cultivated pasture or roots.

In each of the years covered by the report destructive attacks of maize rust (*P. sorghi*) [*P. maydis*] occurred in the lower Rhine Valley of St. Gall, killing the plants in July and August before the cobs had ripened. Attempts to control the disease by spraying were ineffectual and attention was therefore directed to the extermination of the alternate host, *Oxalis stricta*, first observed locally in this capacity in 1945.

The year 1946 was marked by an epidemic of potato late blight (*Phytophthora infestans*), the initial symptoms of which were already visible in the first half of June. The mid-season varieties, especially Bintje and Up-to-date, sustained particularly heavy damage, also involving the tubers in the former. Wart disease (*Synchytrium endobioticum*) was reported from ten municipalities in 1943, from one in 1944, from three in 1945, and from one in 1946. In the very dry spring of 1944 potato emergence was exceedingly slow and irregular, and outbreaks of *Rhizoctonia* [*Corticium*] *solani* were frequent [cf. ibid., xxvi, p. 27]. During the last three years there has been a general increase in the incidence of potato virus diseases [ibid., xxvii, p. 149], the average percentages in the fields inspected for seed certification in 1944, 1945, and 1946 being 16·2, 22·5, and 34·7, respectively, compared with 6·4 in 1943. The rise is attributed, on the one hand, to current difficulties in procuring high-grade seed from abroad, and on the other to adverse climatic conditions.

Beet leaf spot (*Cercospora beticola*) became increasingly prevalent, notably in 1945 and 1946. Copper oxide, copper oxychloride, or Bordeaux treatments [ibid., xxvi, p. 520] are economic in districts where heavy losses have been experienced.

Another disease that appears to be extending its range is clover rot (*Sclerotinia trifoliorum*) [ibid., xxv, p. 455], which caused severe damage in various places, especially during the last three years of the survey.

Simmonds (J. H.). **Report of the Plant Pathology Section.**—*Rep. Dep. Agric. Qd, 1946–47*, pp. 33–35, 1947.

It is stated in this report [cf. *R.A.M.*, xxvi, p. 285] that the wheat varieties Charter and Gabo [ibid., xxvii, p. 69] resistant to rust [*Puccinia graminis* and *P. triticina*] were available in quantity for distribution during 1946–7 and were more frequently used by growers.

An unusual physiological disorder occurred on oats planted in early February, 1947, the emerging seedlings being burned at ground-level during a hot day after a week of wet weather. Some seedlings showed only narrow, necrotic bands on the first leaves, others were killed, but most survived and produced a moderate to good stand.

The summer crop of *Panicum* [*miliaceum*] was seriously affected by blight (*Piricularia grisea*) [ibid., vi, p. 637], causing losses of 20 to 60 per cent. The infected plants showed a leaf spot and the seed failed to develop in one or more sections of the head. Continuous wet weather during the growing-period favoured the development of the infection. Comparative spraying trials carried out at Kingaroy for control of groundnut leaf spot [*Cercospora arachidicola* and *C. personata*: ibid., xxv, pp. 248, 536], in which Burgundy mixture, copper dust, and sulphur dust were used at three-weekly intervals, were not completely satisfactory, although a marked reduction of the disease resulted. Shorter intervals between the applications are suggested. Sulphur was somewhat more effective than the copper preparations.

Grapes suffered severe losses from grey mould [*Botrytis cinerea*: ibid., xxvi, p. 527], Waltham Cross being more seriously affected than Gros Colman, usually most susceptible, owing to the very wet weather during the ripening of the former variety. At the end of the season grapes, particularly Gros Colman, were also heavily infected with bitter rot [*Melanconium fuligineum*: ibid., xxv, p. 332]. The attack followed berry shrivel, caused by hot, dry weather in December and early January, and was presumably induced by the subsequent abnormally wet season.

Water blister (*Ceratostomella paradoxa*) [ibid., xxv, p. 509] was responsible for extensive transport losses in the summer crop of pineapples. Such losses can be almost eliminated, however, by strict hygiene in the packing shed, and in experimental consignments were thus reduced from 30 to 2 per cent.

In order to detect banana stocks free from Panama disease [*Fusarium oxysporum* var. *cubense*: ibid., xxvii, p. 76] a new corm-boring method was devised, by which the presence of the disease can be demonstrated without cutting down the plant.

Attempts were made to control collar rot of tomato (*Alternaria solani*) [ibid., xxv, p. 585] seedlings. Good results were obtained in one experiment where the disease reached serious proportions by watering the seed-bed, immediately after planting, with suspensions of copper oxychloride and fermate.

During the year under review carrot leaf spot (*Macrosporium* sp.) [*A. dauci*: ibid., xxv, p. 88] caused extensive defoliation. Because of the spasmodic occurrence of the disease growers tend to neglect routine spraying.

Favoured by the very wet season the late-summer and autumn crops of cabbage suffered heavily from black rot [*Xanthomonas campestris*: ibid., xxvii, p. 223]. Areas producing crops regularly appeared to be more heavily affected, owing presumably to the carry-over of the pathogen in the soil.

**Twentieth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1946.**—127 pp., 1946.

This report [cf. *R.A.M.*, xxv, p. 539] contains, among others, the following items of interest. Further studies at Canberra on wheat take-all [*Ophiobolus graminis*: see below, p. 180] demonstrated that where wheat has been grown continuously in drums since 1943, yield was significantly depressed where sodium nitrate was

added, while the response to sheep manure was outstanding. Chemical analyses of plants submitted to various treatments and to different forms of exposure to infection have shown that much can be learned by this method about the effects on the disease of the addition of specific fertilizers. Further work along these lines is in progress.

Experiments are being conducted to ascertain whether a certain type of gummosis and die-back of apricots observed at Canberra is due to boron deficiency [ibid., xxi, p. 209], which has been observed in other crops in the vicinity.

Of the six widely grown potato varieties in Australia, three have not yet been freed from virus X [ibid., xxiv, pp. 92, 403; xxv, pp. 42, 62]. An attempt is being made, by the tuber-indexing method, to obtain virus-free material.

Further work at Sydney and Canberra with the protective inoculation method of preventing outbreaks of tomato spotted wilt in the field by infecting the seedlings with a very mild strain of the virus [ibid., xxv, p. 540] resulted in a heavy incidence of the disease, confirming the previous season's observations that the protection afforded is too transitory to be of use. A study was also begun of the relationship of the spotted wilt virus to dahlia [ibid., xxvi, p. 340]. the worst carry-over host. Late in 1945, a severe outbreak on potatoes [cf. ibid.. xxvii, p. 34] at the Experiment Farm, Canberra, and in the Crookwell district. was ascertained to be due to a variant differing from normal spotted wilt virus in that it had lost the most severe strain of the complex. It effected systemic invasion of potato with ease, though the normal virus did so only with difficulty The adapted virus was, under favourable conditions, able to cause rapid and wide spread infection. Varietal susceptibility to this form of the virus is being investigated.

The insecticide, gammexane, was found highly effective in controlling mites infecting stock cultures of fungi.

In the section of this report dealing with forest products investigations (pp. 42–53) it is stated that a statistical survey in Victoria of the preservative treatment of railway sleepers made of eucalyptus wood of low durability [cf. ibid., xxv, p. 195] clearly showed the importance of mechanical failure due to splitting, etc.; it is now obvious that the problem is complicated by the necessity of retarding mechanical failure as well as conferring lasting protection against decay. In experiments on the pressure treatment of eucalypt timbers it was found that at pressures of about 1,000 lb. per sq. in. satisfactory penetration could be obtained in many untreatable by the standard schedules used in other countries. While investigations are in progress to find ways of reducing the pressures necessary, a pilot plant has been erected to determine the practicability of high-pressure treatment for the preservation of rail sleepers.

As a result of further studies on the diffusion method of treating timber with preservatives [ibid., xxv, p. 377], a mathematical theory has been developed to characterize diffusion into green timber.

Muir (J. C.). **Trinidad and Tobago Administration Report of the Director of Agriculture for the year 1946.**—28 pp., 1948.

In the phytopathological section of this report [cf. *R.A.M.*, xxvi, p. 188] C. A. Thorold states that the control of the cacao virus disease [ibid., xxvi, p. 538] was the main objective during 1946. In order to prevent possible infection of trees at the main Cacao Propagating Station in the Santa Cruz Valley, it was decided to destroy all cacao trees within a radius of one mile, involving more than 200 acres of privately owned stock. After a census and survey it was agreed to pay a compensation for healthy trees as assessed by the Land Acquisition Branch of the Crown Lands Department. The trees were felled by cutting the main roots and bole below ground-level. The eradication was planned to be completed early in 1947. In other

areas only trees showing virus symptoms were eliminated. Further inspections are recommended. The virus area is in the north-west and is separated from the central cacao-growing districts by a belt where practically no cacao is grown. It is hoped to localize and prevent the spread of the disease by destroying affected trees in the northern and eastern border regions.

After 18 months of regular weekly applications of Bordeaux mixture for the control of witches' broom [*Marasmius perniciosus*: ibid., xxvi, pp. 383, 537] the trees still showed a few brooms. The extent and incidence of the disease in Tobago remained almost unchanged during 1946, in spite of the continued withdrawal of control measures.

Consignments of sweet potatoes from Tobago suffered serious transport losses due to black rot [*Ceratostomella fimbriata*: ibid., xxvi, p. 528]. The control must begin in the field, where the infection originates, and planting of successive crops on the same plots should be avoided.

Mildew (*Peronospora parasitica*) [ibid., xxv, p. 579; xxvii, p. 167] caused considerable losses among cabbage seedlings in the cotyledon stage in market-gardens at Aranguez and Diego Martin. Bordeaux mixture and perenox were found to be phytocidal to very young seedlings, but daily applications of 0·25 shirlan WS (sodium salicylanilide) proved to be effective in controlling the disease. Cabbage yields were considerably reduced by soft rot (*Erwinia carotovora*) and black rot (*Xanthomonas campestris*). The high incidence of these bacterial diseases is attributed to the continuous cultivation of *Brassica* spp.

Rotation experiments for the control of tomato bacterial wilt (*X. solanacearum*) showed that there was less infection and better yields when tomato succeeded cauliflower than when it followed eggplant or tomato. It is assumed, however, that even the avoidance of solanaceous crops would not give complete control, because the causal bacteria are probably maintained in the soil by certain weeds in the absence of susceptible crops.

Martin (E. F.). **Annual Report of the Department of Agriculture, Uganda Protectorate. Report on Experimental Work for the period 1st July, 1945–31st March, 1946.**—92 pp., 1947.

The following items may be noted in this report [cf. *R.A.M.*, xxvi, p. 145].

In the report on cotton, Serere area (pp. 35–38), P. E. Weatherly states that experimental evidence showed that routine blackarm [*Xanthomonas malvacearum*: ibid., xxvi, p. 452] lesion counts did not demonstrate clearly the resistance of the blackarm-resistant strains as compared with their parental types, though the marked resistance of B 181 and its derivatives was established.

District variety trials were carried out at 19 centres. The major varieties N 17, BP 52, BP 50, and B 181 were grown at most centres, together with KP 28 (related to B 181), S 4105 (Ex N 17 $M_2$), and SP 84 (Ex U4/4/2), according to the locality. The results of the blackarm lesion counts were broadly similar to those of the previous year; B 181 and KP 28 showed strong resistance everywhere, while BP 50 R was superior to the others, and N 17 and its derivatives were conspicuously more susceptible. B 181 gave the highest yield at all centres, though SP 84 approached it in this respect at Katakwi more closely than in recent years. BP 50 R and BP 52 gave somewhat similar yields, rather smaller than B 181. N 17 was almost everywhere outyielded by BP 50 R and B 181 (and KP 28), and by BP 52. There was an approximate correlation between yield and blackarm resistance, but before it can be decided whether the disease is the factor controlling yield it will be necessary to include blackarm-resistant selections of N 17 in the trials.

In the report on food crops (pp. 39–46) by the Botanical Section it is stated that although sorghum smut (*Sphacelotheca sorghi*) [ibid., xx, p. 597] is present only to a limited extent at Serere, varietal resistance has already been observed. A test was

therefore carried out in which the seed of 97 varieties was dusted with the spores of the fungus before sowing. At maturity, 19 varieties had under 10 per cent. smutted heads and 29 over 40 per cent., the remainder being intermediate [cf. ibid., xxvi, p. 197]. In a trial of varietal resistance to groundnut rosette [cf. ibid., xxv, p. 27], the percentages of infection obtained were: Atuboi, 1·8; Bulindi, 3·5; Mubende, 3; B. 353, 1·4; BB. 2, 1·5; S. 183, 3·4; Loc. spreading, 7·8; B. 239, 0·8; West Nile, 0·7; S. 185, 5·1; B. 713, 1; Busoga, 2·9; Teso, 1·3; and S. 721, 2·7. Yields were well up to average in spite of late sowing (May).

WALLACE (G. B.). **Annual Report, Department of Agriculture, Tanganyika Territory, 1947.**—3 pp., [1948].

In this report [cf. *R.A.M.*, xxv, p. 154; xxvii, p. 158] the following are listed among the new records for Tanganyika Territory in 1947: pasmo disease of flax (*Sphaerella linorum*) [ibid., xxv, p. 449; xxvi, p. 396], already reported from Kenya [ibid., xxii, p. 358], was found in one field but was not serious; sugar-cane red rot (*Physalospora tucumanensis*); apple root diseases due to *Ustulina zonata* and *Armillaria mellea*; and *Monochaetia unicornis* [ibid., xxvi, p. 555] on *Cupressus lusitanica*, which may limit further planting.

*Ascochyta rabiei* [ibid., xxiv, p. 8] caused total loss in some chick pea [*Cicer arietinum*] fields. Potato brown rot (*Xanthomonas solanacearum*) [cf. ibid., xxv, p. 154] occurred in a few fields in the Southern Highlands Province. The strain of *Phytophthora infestans* causing potato blight in the Usambaras [loc. cit.] was stated by Dr. W. Black of Edinburgh to differ from strains A, B, and C [ibid., xxvii, p. 151], and to be either an entirely new biotype or a more virulent form of strain C. The virus disease of sweet potato [ibid., xxvi, p. 145] was very mild, as was an attack on the same host by *Plenodomus destruens* [loc. cit.]. In the Northern Province brown rust (*Puccinia triticina*) caused unusually heavy losses in wheat.

**Report of the chief of the Bureau of Plant Industry Soils, and Agricultural Engineering, Agricultural Research Administration,** 38 pp., 1945.

This report contains, *inter alia*, the following items of interest.

Tregal barley, released by the North Dakota Station in 1943, combines the resistance to loose smut [*Ustilago nuda*: *R.A.M.*, xxvi, p. 101] and high yield of Trebi with the smooth awn of Regal. Velvon 11, an improved strain of Velvon barley, shows more resistance to loose and covered smuts [*U. nuda* and *U. hordei*: ibid., xxvii, p. 15] and yields more than the parent strain, although it is possibly not so stiff-strawed.

Acala 1517 WR, a new cotton variety developed at the New Mexico Cotton Field Station and resistant to *Verticillium* wilt [*V. albo-atrum* and *V. dahliae*: ibid., xxii, p. 385; xxvii, p. 19] was selected for release in 1945.

The only nutrient element found to be very low in shortleaf pine trees [*Pinus echinata*] suffering from little leaf [ibid., xxvii, p. 51] was nitrogen, and it was the only one which improved the condition of the trees when added to the soil. A new pine disease called resin canker, caused by a *Fusarium* sp., has been discovered near Asheville, North Carolina, predominantly on Virginia pine [*P. taeda*]. It attacks the central leader but laterals are also invaded and killed. The symptoms of the disease are pitch flow and pitch soaking.

The wild tomato *Lycopersicon peruvianum* var. *dentatum* [ibid., xxii, p. 421], resistant to curly top [beet curly top virus: ibid., xxv, p. 206; xxvi, pp. 521, 530] was hybridized after much difficulty with the common tomato and the hybrid back-crossed to the latter parent. Many of these back-cross lines have an encouraging degree of curly-top resistance.

During 1945 and 1946 disease-resistant sugar-beet varieties were improved. Improved U.S. 15 is more resistant to downy mildew [*Peronospora schachtii*] and

rust [*Uromyces betae*: ibid., xxvi, p. 435] than the original U.S. 15. Tests in 1944 showed that Improved U.S. 215×216, resistant to leaf spot [*Cercospora beticola*: ibid., xxvii, p. 1], was superior to U.S. 215×216 in sugar production by 6·7 per cent.

Pijper (A.). **Bacterial flagella and motility.**—*Nature, Lond.*, clxi, 4084, pp. 200–201, 1 fig., 1948.

In support of his recent suggestion concerning the nature of bacterial flagella and movement [*R.A.M.*, xxvi, p. 443] the author shows 15 enlarged consecutive pictures from a 16 mm. film of a typhoid bacterium describing a clockwise half-turn. It is evident that while the semi-somersault is performed the tail stays where it was and directly the forward movement is resumed the tail is dragged on again. The author considers that if the tail consisted of active flagella it is more or less impossible to imagine how they could bring about the movement illustrated [see next abstract].

Conn (H. J.) & Elrod (R. P.). **Concerning flagellation and motility.**—*J. Bact.*, liv, 6, pp. 681–687, 2 figs., 1947.

The results of the present study, in which *Agrobacterium* [*Bacterium*] *tumefaciens*, *A.* [*Bact.*] *radiobacter*, *A.* [*Bact.*] *rhizogenes*, and strains of *Rhizobium* and *Chromobacterium* spp. were photographed with an electron microscope, suggest that the flagella are definite entities attached to the body of the cell and that many of the motile bacteria examined were too short to propel themselves by means of the undulatory motion described by Pijper [see preceding abstract]. A motile sarcina, a packet of eight cells swimming as a unit, was observed and this certainly is unable to move by the above means. *Bacillus cereus* and *Escherichia* [*Bact.*] *coli* in 'methocel' solutions [loc. cit.] showed only a few flexible cells, most being short and apparently perfectly rigid, but these are just as motile as those that undulate. No 'tails' have been observed.

The authors question the validity of drawing general conclusions as to the mechanism of bacterial movement from Pijper's observations. It is concluded that flagella still have the significance attached to them in the past. Considerable caution should be applied, however, in describing an organism as either peritrichic or monotrichic, since there appear to be species in which the peritrichic flagellation is so degenerate that strains with monoflagellate cells can occur.

Lincoln (R. E.). **Mutation and adaptation of Phytomonas stewartii.**—*J. Bact.*, liv, 6, pp. 745–757, 1947.

The mutation rate of dark and pale yellow stocks of *Phytomonas* [*Xanthomonas*] *stewarti* [*R.A.M.*, xxv, p. 339] was determined at 12°, 18°, 24°, 30°, and 36° C. Mutations were observed in the colour, size, and surface appearance of the colonies. The rate of mutation at 36° was about ten times greater than at 12° with intermediate mutation rates occurring at intermediate temperatures. The two stocks showed a marked difference in their characteristic mutation rates, but in kind and pattern they were similar at the different temperatures. The temperature coefficient of the dark yellow stock was approximately 5, that of the pale yellow stock about 2·5. Certain characters became very mutable at 30° to 36°. It was calculated that even at the highest mutation rate among six stable mutants derived from the dark yellow stock 250 generations would be needed for mutation alone to cause a 1 per cent. increase in a mutant type. In studying the effects of selection in the changing frequency of occurrence of a given type in a mixture of two stocks rapid shifts were observed, indicating that selection may be an important factor in changing bacterial populations.

**Cacao disease in Brazil.**—*Trop. Agriculture, Trin.*, xxiv, 4–6, p. 56, 1947.

In a private communication, P. Silva and W. T. Lellis of the Cacao Institute of Bahia report the more important diseases of this crop so far found in Brazil. Brown pod rot (*Phytophthora palmivora*) [*R.A.M.*, xxvi, pp. 287, 334] considerably reduces yields, but experiments have shown that where the losses exceed 15 per cent. spraying with Bordeaux mixture is economical. In some years die-back or black pod rot (*Diplodia* [*Botryodiplodia*] *theobromae*) [loc. cit.] is as serious as brown pod rot. Red rust or algal disease (*Cephaleuros mycoidea*) [ibid., xiv, p. 566] prevails on unshaded cacao, but can be controlled by removing the affected twigs, spraying with Bordeaux mixture, and increasing the overhead shade. Pink disease (*Corticium salmonicolor*) [ibid., v, p. 349] is also important.

Mourashkinsky (K. E.). 'Истекание' зерна ('медовая роса') как причина вызывающая щуплость зерна. [Bleeding grain ('honeydew') as the cause of grain stickiness.]—3 pp., Omsk, Омский сельскохозяйственный институт имени С. М. Кирова [S. M. Kiroff's Institute of Agriculture], 1944. [Received February, 1947.]

This popular account deals with the incidence of 'bleeding' grain, known to the farmers of Western Siberia as 'honeydew' [*Claviceps purpurea*: *R.A.M.*, xix, p. 391] and representing a serious threat to cereal crops in the Omsk district. The increased incidence of the disorder in this region during recent years may be explained by the widespread use of a new winter rye variety, Vyatka, which is apparently very susceptible.

Field experiments showed that the disease caused weight reductions of 16·5 to 48 per cent. in the air-dry wheat grain and farmers' reports indicated reductions of up to 60 per cent. Data indicate indirectly that severe rust infection, particularly black rust [*Puccinia graminis*], favours the development of 'bleeding grain'. The only practicable control measure is prompt harvesting and stooking.

Yarkina (Mme A. M.). Селекция яровой Пшеницы на устойчивость к грибным болезням. [Selection of spring Wheats resistant to fungal diseases.]—*Socialist. Grain Fmg, Saratoff, 1946*, 2–3, pp. 35–44, 1946.

This study deals with methods of selecting and breeding spring wheats resistant to rusts and smuts in south-eastern U.S.S.R. during the last six years. Of the numerous varieties tested for resistance to brown rust [*Puccinia triticina*: *R.A.M.*, xx, p. 455; xxvii, p. 11] and black rust [*P. graminis*: ibid., xix, p. 137], the Lutescens selections 605 and 758 were resistant to the former, but none to the latter.

In the 1944 tests 47 out of 54 $F_5$ derivatives of Albosar × Lutescens 514 were resistant to loose smut [*Ustilago tritici*: ibid., xxi, p. 191], many of which produced high yields. In 1945 Pirotriks 1065 and Lutescens 1422 and 1465 showed resistance to loose smut and were good yielders. Lutescens 605 and 758 were slightly susceptible in 1945 but fully resistant in 1946.

The resistance to bunt [*Tilletia caries*: ibid., xxi, p. 519] of Lutescens 605 and 758 varied greatly during the period under review, but the selected progenies of both varieties were fully resistant in 1945.

Kozhevnikova (Mme L. M.). Новая болезнь озимых в Пензенской области. [A new disease of winter cereal crops in the Penza district.]—*Socialist. Grain Fmg, Saratoff, 1946*, 4, pp. 46–50, 1946.

A destructive disease of winter cereal crops, which has occurred during recent years in the Penza district and has not been recorded hitherto in the U.S.S.R., is attributed to *Typhula itoana* [*R.A.M.*, xix, p. 434; xxvi, p. 9]. Investigations

carried out at the Penza Experimental Station during 1945 showed that 38·6 per cent. of the winter wheat was attacked at the end of March, but the incidence of the disease increased sharply after a snowfall in mid-April, resulting in losses of 58·8 to 70 per cent. In 1946 also the loss amounted to 70 per cent.

Seedlings of winter wheat and rye, particularly those near remaining snow patches, bore a grey mycelium on the leaves and lower parts of the stems and a web-like mycelium spread on the soil surface. The developing sclerotia, varying from round and flat or spherical to elongated and irregular, measured 0·5 to 7 mm. in diameter and were formed mostly in the lower section of the plant. High temperature and low humidity appear to favour the development of dark sclerotia, as white ones transferred from field to laboratory soon became dark.

The development and propagation of the disease are identical with that caused by *Sclerotinia graminearum* [ibid., xviii, p. 581], but it differs in the size and shape of the sclerotia and their position in the tissues.

Esfandiari (E.). **Les rouilles de céréales en Iran.** [Cereal rusts in Iran.]—*Ent. Phytopath. appl., Tehran, 1947*, 4, pp. 67–76, 5 figs., 1947. [Persian, with French summary.]

Rusts (*Puccinia* spp.) of wheat and barley are fairly prevalent in Iran, where they may reduce the crops by as much as 30 per cent. in damp seasons; oats and rye are not cultivated in the country. Wheat is most severely attacked by yellow rust (*P. glumarum*), other hosts of which include various grasses, such as *Agropyron*, *Brachypodium*, *Bromus*, and *Elymus* spp. Black rust (*P. graminis*) is generally less widespread except in certain regions of the steppes and mountains, overwintering in the former mainly by means of uredospores produced on wheat stubble and wild grasses, and in the latter on barberries, of which *Berberis integerrima* is preferred as an alternative host to *B. vulgaris*. Brown rust (*P. triticina*) rarely occurs except in a few southern localities, where it often accompanies *P. glumarum*. The aecidial stage has not yet been observed on *Thalictrum* in Iran.

Yellow rust of barley is coextensive with the cultivation of the crop throughout the country, black rust has been found only in Gorgan, and *P. simplex* [*P. hordei*] is restricted to wild species of *Hordeum*, e.g., *H. bulbosum* and *H. violaceum*.

Bever (W. M.). **Physiologic races of Ustilago tritici in the eastern soft Wheat region of the United States.**—*Phytopathology*, xxxvii, 12, pp. 889–895, 1947.

At the Illinois Agricultural Experiment Station 52 collections of *Ustilago tritici* from 15 States of the eastern soft wheat region from New York to Texas yielded 11 pathogenically distinct physiologic races [*R.A.M.*, xv, p. 431], to which numbers from 1 to 11 have been assigned. Race 1 predominated, having been encountered in seven States, while Nos. 4, 8, and 9 were each represented only once, in Kentucky, North Carolina, and Texas, respectively. Six races (1, 3, 5, 9, 10, and 11) were obtained from Texas, five (2, 3, 6, 7, and 8) from North Carolina, five (1, 2, 3, 5, and 6) from Georgia, four (1, 3, 4, and 7) from Kentucky, three (1, 7, and 11) from Illinois, three (3, 5, and 7) from South Carolina, two (1 and 10) from Indiana, and one each from New York (1), Ohio (11), Michigan (1), Missouri (1), Maryland (6), Virginia (7), Tennessee (7), and Arkansas (10).

The average percentages of smutted heads in ten winter wheat varieties inoculated with the 11 races of loose smut and the distinguishing characteristics and original sources of the latter are tabulated. The experimental results indicate the possibility of developing through hybridization a soft winter wheat variety combining attractive agronomic qualities with a high degree of resistance to the physiologic races under discussion [ibid., xxvi, p. 385].

HOLTON (C. S.). **Host selectivity as a factor in the establishment of physiologic races of Tilletia caries and T. foetida produced by hybridization.**—*Phytopathology*, xxxvii, 11, pp. 817–821, 1947.

Further studies have confirmed the author's previous conclusion that varietal selectivity is an important factor in the establishment of new pathogenic lines of wheat bunt (*Tilletia caries* and *T. foetida*) produced by hybridization [*R.A.M.*, xxii, p. 200]. Thus, the highly susceptible Hybrid 128 [ibid., xxvii, p. 13] tends to promote the establishment of races of low virulence, e.g., Nos. 52 a and 53 a, derived from crossing T–8 with T–9. No. 52 a caused 85, 13, 1, and 0 and No. 53 a 64, 2, 6, and 1 per cent. infection on Hybrid 128, Albit, Hohenheimer, and Selection 10068–1, respectively. With highly resistant varieties, on the other hand, the position is reversed, Sel. 10068–1, for instance, establishing the more virulent races from T–8 × T–9, namely, Nos. 50 c, 52 b, 54 b, and 55 c, causing infection percentages on Hybrid 128, Albit, Hohenheimer, and Sel. 10068–1 of 78, 21, 55, and 14; 84, 67, 72, and 34; 92, 9, 60, and 23; and 87, 17, 84, and 51, respectively.

Repeated selection of inoculum of T–8 × T–10 from the susceptible Hybrid 128 established a pathogenic line (No. 62 a) combining the attributes of both parents [ibid., xvi, p. 164] and causing 93, 51, 77, and 4 per cent. infection, respectively, on Hybrid 128, Albit, Hohenheimer, and Sel. 10068–1. A line selected from Hohenheimer (62 b) did not differ materially from the T–10 parent, but a new, highly virulent type (62 c) was established by selection from Sel. 10068–1, causing 90, 70, 89, and 63 per cent. bunt on Hybrid 128, Albit, Hohenheimer, and Sel. 10068–1, respectively.

The results have been partially substantiated by practical experience in the introduction of new bunt-resistant wheat varieties, which is usually followed, sooner or later, by the development of a physiologic race capable of attacking them [ibid., xvi, p. 166].

SLAGG (C. M.) & FELLOWS (H.). **Effects of certain soil fungi and their by-products on Ophiobolus graminis.**—*J. agric. Res.*, lxxv, 11–12, pp. 279–293, 2 figs., 1947.

Isolations from Kansas soils both free from and infested with *Ophiobolus graminis* [*R.A.M.*, xxvii, p. 14], the causal organism of wheat take-all, yielded fungal isolates some of which or their by-products inhibited and others stimulated the growth of the pathogen. *Trichoderma lignorum* [*T. viride*: ibid., xviii, p. 664; xxiii, p. 130], *Aspergillus niger*, and *Gliocladium fimbriatum* all killed *O. graminis* when grown on potato dextrose agar in the same Petri dish, *T. viride* being parasitic. Colonies of *A. flavus*, *A. nidulans*, and *Penicillium lilacinum* showed mutual repulsion with *O. graminis* before the hyphae met. Filtered potato dextrose solution in which strains of *A. flavus* and *A. flavipes* had grown reduced the development of *O. graminis* by 80 per cent. or more, while substances produced by *A. niger* and *A. terreus* were completely inhibitory. When grown in soil solution, however, the same fungi produced substances which stimulated the growth of *O. graminis*. Twenty of the soil isolates produced substances that reduced the growth by 50 per cent. or more.

*A. niger* grown in Czapek's solution with ammonium chloride or sodium nitrate developed by-products that completely inhibited *O. graminis*, but only slight inhibition resulted when it was grown with ammonium nitrate or urea. By-products of *G. fimbriatum*, however, inhibited *O. graminis* only when the two last-named nitrogen sources were used. *Rhizopus nigricans* [*R. stolonifer*] developed inhibitory by-products only when ammonium chloride was added to Czapek's solution. By-products of eight soil fungi grown in potato dextrose solution stimulated the growth of *O. graminis* by 25 per cent. or more. The production of inhibitory or stimulatory

by-products by any fungus was found to vary with its stage of growth and the composition of the culture medium. *R. stolonifer*, for example, produced toxic substances during its early growth and stimulatory ones later. The application of certain soil amendments may enable some very common soil fungi to produce by-products either anti- or probiotic to *O. graminis*.

*T. viride*, *A. flavus*, and *Fusarium moniliforme* [*Gibberella fujikuroi*] added to artificially infested soil each gave fair to good control of take-all. *A. niger* and *G. fimbriatum* also decreased the pathogenicity of *O. graminis* on wheat. *A. flavus* was shown to reduce the severity of take-all in naturally infested soil. Less pathogenic strains of *O. graminis* were more susceptible to inhibitory action by soil fungi than the highly virulent ones.

Simmonds (P. M.). **The influence of antibiosis in the pathogenicity of Helminthosporium sativum.**—*Sci. Agric.*, xxvii, 12, pp. 625–632, 1 fig., 1947.

This study deals with investigations into the antibiotic effects of the natural surface flora on wheat infected with *Helminthosporium sativum* [*R.A.M.*, xxv, p. 257]. Generally only small amounts of the pathogen are present on wheat stubble in the field, but occasionally high percentages were found. In inoculation tests a good, sporulating growth of *H. sativum* was obtained on sterilized stubble pieces, but growth was inhibited on unsterilized pieces, on which, however, an abundant growth of various fungi and bacteria was observed. It is assumed that the natural stubble contains antibiotic organisms originating in the soil; this would also explain the low incidence of the fungus on stubble in the field.

Experiments with inoculated green culm pieces showed that on those moistened and incubated before inoculation the growth of *H. sativum* was inhibited, the incubation presumably being conducive to the development of the surface flora. On the corresponding dry non-incubated pieces the pathogen grew and sporulated well.

Dry wheat grain and grain incubated in a moist chamber for various periods were placed at the margin of a colony of *H. sativum* growing on potato dextrose agar. Those incubated for 16 hours exerted an inhibitory effect on the fungus, the maximum of antibiosis being reached after 24 hours' incubation. Dry grain did not affect the growth of the pathogen.

Forty-three seven-day-old seedlings emerging from grain incubated for 24 hours and then inoculated bore no lesions, while 22 showed them. From non-incubated grain, where no surface flora was active, only 16 seedlings were clean and 46 had lesions. Almost all the seedlings from incubated, formalin-treated grain bore lesions on the coleoptile, while the untreated ones, with an active natural flora, showed only a few lesions.

Reward grain was dipped into a suspension of an antibiotic bacterium isolated from Reward wheat kernels, incubated, and then inoculated with *H. sativum*; the bacteria gave a good protection to the seedlings. Other wheat varieties grown at Saskatoon showed a good percentage of kernels with strong to slight antibiotic bacterial growths when tested against the pathogen. The germination of *H. sativum* conidia was retarded in proximity to these antibiotic bacterial colonies.

The evidence obtained in these experiments indicates a widespread and prevalent occurrence of a bacterial surface flora antagonistic to *H. sativum* on various parts of cereal plants. The author stresses the importance of the flora in seedling testing for varietal resistance and in seed treatments with various fungicides.

Sallans (B. J.). **Interrelations of common root rot and other factors with Wheat yields in Saskatchewan.**—*Sci. Agric.*, xxviii, 1, pp. 6–20, 2 graphs, 1948.

The data contained in this study confirm previous findings that common root rot (*Helminthosporium sativum* and *Fusarium* spp.) [*R.A.M.*, xix, p. 650; xxiii, p. 96] is responsible for considerable reductions in wheat yields. The estimated

average loss in Saskatchewan over the past ten years of 5·14 bush. per acre represents about one-third of the yields actually harvested. In order to determine the relation of common root rot to wheat yields, correlation and partial regression methods were used. Statistics of various factors affecting yields, e.g., rainfall before and during the growing season, air temperatures in June and July, and insect damage, were assembled from nine crop districts over a period of ten years. The calculated common root rot ratings, or estimates of loss, based on samples taken from 10 to 20 places at more or less regular intervals, ranged from 3·4 per cent. in one district in 1939 to 17·8 in another district in 1936, the simple average for the 64 crop district years being 8·8 per cent. of the crop. While heavy rains during June and July tend to suppress root rot lesions, light rainfall appears to increase their incidence and severity. Pre-seasonal rainfall and June–July rainfall favoured wheat yields. Depressing effects on yields were indicated by partial correlations between yields and air temperature, common root rot, and insect damage. The variance in yield due to common root rot was second only to that related to June–July rainfall.

Johnson (T.). **A form of Leptosphaeria avenaria on Wheat in Canada.**—*Canad. J. Res.*, Sect. C, pp. 259–269, 6 figs., 1 pl., 1947.

In the late summer of 1942, pycnidia of a species of *Septoria* were found frequently on wheat leaves (rarely on the heads) and in one instance on barley leaves in the Prairie Provinces of Canada. In 1943 traces of the same fungus were observed on wheat samples from Western and Eastern Canada and in 1944 much wheat in Manitoba was infected, mostly only lightly. It was also detected on wheat specimens from Ontario, Quebec, and the Maritime Provinces. In 1945 the wheat in Manitoba was generally infected and in 1946 infection was widespread but light.

In 1942 and 1943 perithecia belonging to the genus *Leptosphaeria* were occasionally associated with the *Septoria* and in 1944 both fructifications occurred abundantly on wheat leaves at Winnipeg and Gimli in Manitoba. Proof of the genetic connexion of the two states was established by the development of perithecia in cultures derived from pycnidiospores and of pycnidia in cultures from ascospores.

Morphologically, the organism conforms closely in both perfect and imperfect states with *L. avenaria* [*R.A.M.*, xxv, p. 155], but differs in symptoms, host range, length of incubation period, and cultural characteristics. It has longer spores than *S. nodorum* [ibid., ii, p. 211; xxv, p. 337] and does not cause the characteristic purplish-brown glume blotch, although the extreme margins are frequently brown and the terminal parts of glumes and lemmas often show a faint, light-brown discoloration. It differs from *S. nodorum* also in its longer incubation period and its inability to attack certain wheat varieties susceptible to *S. nodorum* and from *S. avenae*, in symptoms, host range, length of incubation period, and cultural characters. Pathogenically it is weaker than either of these species.

The fungus is regarded as a forma specialis of *L. avenaria* and is named *L. avenaria* f.sp. *triticea* n.f.sp. It is described as causing ovate, straw- or buff-coloured, frequently coalescing lesions on the leaves with usually grey pycnidia in the centre. They are sometimes followed in late summer by sub-epidermal, later erumpent, globose or subglobose perithecia, black by reflected, brown by transmitted light, 100 to 220 $\mu$ in diameter, with an ostiole 14 to 20 $\mu$ in diameter; the clavate, straight or slightly curved, hyaline asci, 40 to 80 by 8 to 11 $\mu$, contain eight biseriate, fusoid, straight or curved, triseptate, pale yellow ascospores, (16) 19 to 25 (28) by 4 to 6 $\mu$; the filamentous, septate, hyaline paraphyses are slightly longer than the asci.

The pycnidial state (which is named *S. avenae* f.sp. *triticea* n.f.sp.) comprises subepidermal, later erumpent, scattered, spherical or slightly elongate pycnidia, black by reflected or golden-brown by transmitted light, (80) 90 to 140 (210) $\mu$

in diameter; the wall contains three or four layers of brown cells, 7 to 11 μ thick at the base and 11 to 14 μ at the top; the circular or oval ostiole measures 10 to 15 μ in diameter; the hyaline to faintly chlorinous, thin-walled, cylindrical, straight or slightly sinuate pycnidiospores are obtuse or rounded at the ends, tri- or rarely quadriseptate, and measure (18) 26 to 42 (53) by (2·3) 2·8 to 3·5 (4·2) μ. The spores are generally somewhat shorter and thinner than those of *S. avenae*.

El-Helaly (A. F.). **The black-point disease of Wheat.**—*Phytopathology*, xxxvii, 11, pp. 773–780, 1947.

Black-point or kernel smudge of wheat, which is widely distributed in Lower Egypt and decreases gradually southwards, was found to be due to a species of *Alternaria* [*R.A.M.*, xxi, p. 121]. Mycelium was found in the pericarp and integument but not in the aleurone layer, starch cells of the endosperm, or embryo. Of the factors governing the spread of the disease, the most important are the presence of spores of the fungus in the air, atmospheric humidity and rainfall, soil humidity, and size of the grain. The incidence of infection is correlated with the extent of precipitation and relative humidity in the different localities. For instance, in 1941 at Sakha, where the mean daily relative humidity in March, April, and May was 84, 72, and 62 per cent., respectively, and the monthly rainfall over the same period 22·2, trace, and 0 mm., respectively, the percentages of black-point on the Giza 114 (very susceptible) and Baladir 116 (moderately susceptible) varieties were 62·5 and 20, respectively. At Aswan, where the corresponding relative humidities and rainfall were 21, 16, and 11 per cent. and 0, 3, and trace mm., respectively, the two varieties developed 2 and 1 per cent. infection, respectively. In four varieties grown in an area irrigated several times during the season the percentage of black-point ranged from 3·5 to 12·5 per cent. compared with a uniform incidence of 1·5 per cent. in another region where only one irrigation was applied. Generally speaking, the larger the grain the heavier the attack. The large kernels force open their covering glumes, thereby affording ingress to the spores, whereas the glumes of the small kernels remain closed and so avoid infection even under conditions favouring its development. The comparative resistance of the Hindi D, Giza 7, Giza 102, Hindi 62, Giza 100, and Giza 121 varieties is attributed in the main to their small grains. Samples of these varieties from Sakha (northern Lower Egypt) contained, respectively, 5, 10, 10, 12, 13, and 12 per cent. black-pointed kernels, as against 20, 48, 44, 60, and 62·5 per cent., respectively, in Baladi 116, Giza 74, Giza 116, Giza 115, and Giza 114. The corresponding figures for samples from Gemmeza (southern Lower Egypt) were 2, 3, 3, 2, 3, and 8, respectively, for the resistant, and 12, 12, 20, 20, and 31·5, respectively, for the susceptible group.

Arny (D. C.). **Inheritance of resistance to spot blotch of Barley.**—Abs. in *Phytopathology*, xxxviii, 1, p. 1, 1948.

In seedling tests on the $F_2$ and $F_3$ generations of several barley crosses, the difference between susceptibility and resistance to spot blotch (*Helminthosporium sativum*) [*R.A.M.*, xxv, p. 544] appeared to be due to a single factor pair, with susceptibility dominant. No correlation could be detected between spot blotch reaction and response to stem [black] rust [*Puccinia graminis*], but the results of small-scale tests indicated an association between resistance to *H. sativum* and the xantha character of Colsess IV. In one cross susceptibility to spot blotch was apparently correlated with resistance to stripe (*H. gramineum*) [ibid., xxv, p. 107].

Fischer (G. W.). **Hybridization between Ustilago hordei and Ustilago bullata.**—Abs. in *Phytopathology*, xxxviii, 1, p. 9, 1948.

Crosses between one collection of *Ustilago hordei* from *Elymus canadensis* and four races of *U. bullata* [see below, p. 240] gave rise to several interspecific

hybrids, the $F_1$ spores of which germinated so erratically that they themselves, rather than monosporidial cultures from them, had to be used to provide the $F_2$ generation. When *U. bullata* from *Bromus tectorum*, having verrucose spores with a uniformly coloured wall, was crossed with *U. hordei*, which has smooth spores with a wall lighter coloured on one side, the $F_1$ and $F_2$ spores were echinulate and distinctly paler on two sides. Crosses between *U. bullata* from *B. purgans*, having large (8 to 11 $\mu$) verrucose spores with a uniformly coloured wall, and *U. hordei*, with smaller (5 to 8 $\mu$), parti-coloured spores, yielded $F_1$ spores 5 to 9 $\mu$ in diameter and minutely echinulate, with a tendency to paler coloration on two sides. Segregation in the $F_2$ took place as follows: small (7 to 10 $\mu$), echinulate, tending to be lighter coloured and more strongly echinulate on one side; small (6 to 9 $\mu$), smooth, paler on two sides; large (13 to 16 $\mu$), punctate, with uniform wall; and large (11 to 12 $\mu$), echinulate, with paler coloration and stronger echinulation on one side.

Andersen (A. L.). **The relation of pH to sporulation and growth of Gibberella zeae on agar and in liquid media.**—Abs. in *Phytopathology*, xxxviii, 1, p. 1, 1948.

The sporulation and growth of *Gibberella zeae* [the agent of seedling blight of maize and other cereals] are directly influenced by the initial pH of the culture medium, the composition of which, especially in respect of nutrient concentration and nitrogen source, is also important. On potassium nitrate agar media sporulation reached a maximum with an initial pH of 3 to 3·3, whereas the optimum initial for ammonium nitrate agar was 4·3. In similar liquid media maximum sporulation occurred with an initial adjustment of pH 5 to 6. On potassium nitrate agar the period of pH shift (which occurred on nearly all substrata as growth advanced) was closely correlated with that of rapid sporulation; in the case of media with an initial pH below 7 the reaction veered towards alkalinity, whereas on those starting above this figure the first movement was towards neutrality with a subsequent change backwards. Media with high carbon and nitrogen contents produced more mycelium and fewer spores than did those low in these ingredients, while the optimum initial pH for mycelial production was higher in the latter than in the former.

Calavan (E. C.) & White (F. A.). **Dry bark of Lemons.**—*Calif. Citrogr.*, xxxii, 12, pp. 526, 544, 2 figs., 1947.

Dry bark severely damages six- to 15-year-old Eureka lemon trees and older Lisbon trees, particularly on the coast of California, but has also been detected far inland. It kills the outer and middle bark layers on the trunk and lower branches and dries the cambium to a yellowish shade [cf. *R.A.M.*, xxvii, p. 129]. It affects the bark to a greater depth than does shell bark [ibid., xxvi, p. 394] and instead of shelling, the affected bark cracks vertically and becomes cross-checked. The pale-reddish spotting which develops in the middle bark in the early stages during late winter resembles early shell bark symptoms. The lesions usually appear near the bud union or branch-forks and frequently merge together; they occasionally extend to the rootstock but are soon delimited and corked off. Branch and trunk girdling by the lesions starves the roots and causes the bark to rot. Top symptoms include yellowing of leaves, severe defoliation, lack of new growth, and a reduction of bloom and fruit set. Affected trees soon present a generally ragged appearance. Since susceptibility to dry bark or the disease itself appears to be transmitted through the scion bud, it may possibly be caused by hereditary weakness, clonal senescence, or virus infection. Fungi, although important in the disease complex, are secondary, none producing dry bark lesions as a result of inoculations. Dry bark seems to be an extremely severe form of shell bark and may be due to the same causes. Its development appears to be favoured by high relative humidity, since disease incidence increases with greater proximity to the ocean, and lesions

appear more frequently under moist conditions than in hot, dry weather. No natural spread of the disease has been observed and so far no evidence of transmission to healthy trees through budding or grafting has been obtained.

Care should be taken that new trees are grown from disease-free budwood, the sources of which should be locally grown parent trees known to be free from both shell and dry bark for more than 20 and 30 years for the Eureka and Lisbon varieties, respectively. Testing of various strains and clones for resistance to both disorders is in progress and certain selections show considerable promise.

Klotz (L. J.), Stewart (W. S.), & Bumgardner (R. J.). **Rind spot and drop of Valencia Oranges.**—*Calif. Citrogr.*, xxxiii, 1, pp. 36–37, 2 figs., 1947.

Rind breakdown and accompanying drop of Valencia orange fruits [*R.A.M.*, xiv, p. 233] caused severe losses in some groves in Orange County, California, in the summer of 1947. An extensive survey demonstrated that 30 per cent. of the fallen fruit had rind spots, including typical Valencia rind spot, shoulder spot, and breakdown round the stem. The heaviest dropping occurred during the week beginning 11th August, when the average was 48 dropped fruits per tree. The periods of greatest drop coincided with those when the temperature was highest (103° F.).

In the case of Valencia rind spot, it is assumed that in the absence of visible injury some weakness of the rind precedes the actual breakdown and spotting. In the advanced stage the lesions resemble one form of water spot [ibid., xxiv, p. 411; xxvi, p. 486] on the stem half of navel oranges. As the lesions age, *Colletotrichum gloeosporioides* and *Alternaria citri* may become established in them, causing them to darken and enlarge still further. They may also be vantage-points for the entry of blue and green moulds [*Penicillium italicum* and *P. digitatum*].

Hot weather, rains, and high humidity may be important factors in the development of rind spot of the stem-end half. Coastal fogs may also play a part. In a further laboratory experiment [cf. ibid., xiv, p. 234] susceptible Valencia oranges subjected to a fine spray of distilled water were kept at 100° to 105° and 95 per cent. relative humidity; typical spotting developed after one week. Spraying with 2, 4–D certainly decreased dropping in the field and appeared to reduce 'dry stem', but whether spotting was affected was undetermined; the treatment had no effect on spotting under laboratory conditions. Fruits with incipient spotting developed definite spots after washing in the packing-house, which suggests a relationship with water spot and water rot. Fumigation and ethylene treatment also appeared to aggravate the condition.

Smoyer (K. M.). **Suggestions on how to get along with quick decline.**—*Calif. Citrogr.*, xxxiii, 1, pp. 6, 18, 1947.

Quick decline of orange trees [*R.A.M.*, xxvii, pp. 130–132] continues to spread in the heavily infected parts of California, while advancing slowly, also, into the citrus districts adjacent to the infected areas. The disease begins slowly, requiring four or five years to reach serious proportions in a given locality, but after this the number of infected trees approximately doubles each year. At present the two problems of control are the retardation of spread and the handling of a newly infected orchard.

The best way of retarding spread (in lightly affected areas and those adjacent to infected ones) would seem to be to remove every tree as soon as it shows any sign of the disease. The effectiveness of this method is purely conjectural, but it has the support of experienced growers. The trees removed should be replaced with growing trees on resistant rootstocks.

A vigorous replanting programme and interplanting are also recommended for newly infected orchards. An interplant programme appears by far the more suitable method for open orchards entirely on sour-orange stocks. In the infected

parts of Los Angeles County a replant programme should be based on sweet-orange as a rootstock. There is also good evidence that oranges on grapefruit stocks do not develop quick decline. If a sensible programme of replacement is adopted the losses can be minimized and no pronounced effect on the citrus industry as a whole need be feared.

Ruggieri (G.). **Un caso di foliocellosi di carattere ereditario.** [A case of foliocellosis hereditary in character.]—Reprinted from *Ital. agric.*, *1947*, 11, 4 pp., 1 fig., [? 1948].

After briefly describing the symptoms of citrus foliocellosis [*R.A.M.*, xi, p. 26] and pointing out that it can be either of a transitory or of a semi-permanent nature, the author recapitulates the various factors that induce the condition and states that hereditary factors can play a part. Buds from a sweet-orange tree at Messina, about ten years old, with chlorotic leaves typical of the condition, were grafted in the spring of 1943 on to vigorous sour-orange trees growing in the same field. In 1945 the new vegetation reproduced the symptoms seen on the mother plant, the anatomical characters of the new, spotted leaves resembling those described by other workers for cases of foliocellosis.

These observations demonstrate that foliocellosis, while it represents a single pathological process possessing well-defined characters, may arise in various ways, one of which is through vegetative mutation.

Orian (G.). **Bud rot of the Royal Palm in Mauritius.**—*Rev. agric. Maurice*, xxvi, 5, pp. 223–258, 4 pl., 1947.

After reviewing in detail earlier studies on bud rot (*Xanthomonas vasculorum*) [*R.A.M.*, xxvi, p. 234] of royal palm (*Roystonea regia*) in Mauritius, and describing the symptoms of the disease, the author gives details of the isolation of the bacterium from affected material, its morphology and growth in culture, and presents proofs of pathogenicity [ibid., xxiv, p. 368]. Inoculations with a culture which had produced typical gumming symptoms when inoculated into sugar-cane were made into royal palm, coco-nut, and white palm (*Dictyosperma album*). On 23rd March, 1945, young royal palms in pots were injected in the stem and spindle with a pure culture from infected royal palm, and others with a pure culture of *X. vasculorum* from sugar-cane. After one month the heart-leaves of inoculated plants and those immediately next outside were dead. The central spindle and growing point had rotted completely and gum was oozing from the cut surfaces of the young sheaths. The tissues round the stem punctures were light brown and many of the fibres in the stem had turned yellow to brown and were oozing gum. Other inoculations on tall six-year-old royal and white palms gave similar results, both with the cultures from royal palm and those from sugar-cane. Coco-nut palms appeared to be much more resistant to inoculations than the royal and white palms, the plants often recovering completely. The identity of the reisolates from the inoculated hosts was established by inoculations into sugar-cane blades, when characteristic symptoms of gumming disease resulted. No salient differences could be detected between the different isolates as regards their cultural and physiological reactions.

Isolates of the strains from sugar-cane, royal and white palms, and *Thysanolaena maxima* [*T. agrostis*] were compared by Dr. W. J. Dowson of Cambridge University with sugar-cane strains of *X. vasculorum* from Australia and Puerto Rico. The six strains were similar in all respects except that the four Mauritius strains did not liquefy gelatin, whereas the other two liquefied it slowly, and the Puerto Rico strain was actively lipolytic while the other five were not.

The paper terminates with a discussion of the appropriateness of the term 'bud rot' applied to this disease of palms, the production of variants by the causal

organism, and the importance to the local sugar industry of the presence in Mauritius of a number of natural hosts of the organism. A list of 42 references is appended.

Mains (E. B.). **New and interesting species of Cordyceps.**—*Mycologia*, xxxix, 5, pp. 535–545, 3 figs., 1947.

Continuing his investigations on *Cordyceps* [*R.A.M.*, xix, p. 405] the author gives technical notes on *C. washingtonensis* n.sp., found on buried lepidopterous larvae at Baker Lake, Washington, *C. olivascens* n.sp., associated with the remains of an unidentified insect in rotten wood humus in Alabama, *C. salebrosa* n.sp., from a beetle imago, Barro Colorado Island, Panama Canal Zone, and *C. venezuelensis* n.sp. on a lepidopterous larva in Venezuela.

Wedberg (S. E.) & Clarke (N. A.). **A simple method for controlled experimentation on the passage of micro-organisms through the digestive tract of insects.**—*J. Bact.*, liv, 4, pp. 447–450, 2 figs., 1947.

A method of controlled feeding of insects to facilitate the microbiological examination of their stools has been devised. The insects are mounted on their backs on a paraffin block, attached to a glass rod fixed over the mouth of a battery jar with a little water at the bottom, and fed by means of a tuberculin syringe with drops of sucrose solution containing yeast extract, to which may be added pure cultures of organisms to be investigated. The stools are collected on agar plates or on differential media placed below the paraffin block and resting on the top of the battery jar.

Zwirn-Hirsch (H. E.). **Nematode destroying fungi isolated from sheep dung.**—*Palest. J. Bot.*, J. Ser., iv, 1, pp. 56–57, 1947. [Hebrew summary.]

A species of *Dactylella* with triseptate spores, developing under humid conditions on a piece of sheep dung collected in Jerusalem in February, 1946, was found ensnaring nematodes. In attempting isolations of the fungus it was overrun by another of very similar general appearance but having smaller, uniseptate conidia and probably belonging to the genus *Arthrobotrys*. When nematodes from the original dung culture were added to a pure culture of the latter species they were captured by loops of the type described by Drechsler as characteristic of *A.* spp. [*R.A.M.*, xvii, p. 36]. Trials are in progress on the control of nematodes by means of the *Arthrobotrys* [ibid., xxiii, p. 436].

Giddings (N. J.). **Some studies of curly top of flax.**—Abs. in *Phytopathology*, xxxvii, 11, p. 844, 1947.

Diseased flax specimens received from the San Joaquin Valley [California] in the spring of 1945 were found to be infected by the [beet] curly top virus [*R.A.M.*, xxiii, p. 487]. Greenhouse tests on 37 species and varieties of flax with different strains of the virus have shown all the commercial varieties to be susceptible to infection by each of the strains and to severe damage by the more virulent ones. Virus strains 7, 2, and 4 were the least injurious, while 5, 6, 9, and 3 were highly pathogenic, causing heavy mortality among the plants of most varieties. *Linum lewisii* (T. Payne, seedsman), *L. perenne*, and *L. flavum*, both from Aggler and Musser Seed Company, appear to be very resistant to the virus.

McKay (R.) & Loughnane (J. B.). **Notes on Flax diseases in 1946.**—*J. Dep. Agric. Eire*, xliv, pp. 37–40, 1947.

Damping-off (*Rhizoctonia* spp.) was the most prevalent fungous disease of flax in Eire in 1946 [cf. *R.A.M.*, xxvi, p. 339], being represented in 21 out of the 71 samples submitted by inspectors to the Department of Plant Pathology, University College, Dublin. Next in order came rust (*Melampsora lini*), grey mould (*Botrytis*

*cinerea*), *Phoma* spp., stem-break and browning (*Polyspora lini*), *Alternaria* spp., seedling blight (*Colletotrichum linicola*), wilt (*Fusarium lini*), and stalk disease (*Sclerotinia sclerotiorum*), with 13, 12, 9, 7, 4, 2, 2, and 1 samples, respectively. The non-parasitic troubles included one instance of 'droop' [loc. cit.] on the Stormont Gossamer variety. Liral Monarch was entirely free from fungal infection, but Liral Crown, Liral Prince, and Stormont Gossamer were attacked by several of the above-mentioned pathogens. None of the diseases was destructive in character.

Ocfemia (G. O.), Celino (M. S.), & Garcia (F. J.). **Further studies on transmission of bunchy top and mosaic of Abacá (Manila Hemp plant), separation of the two diseases, and mechanics of inoculation by Pentalonia nigronervosa.**—*Philipp. Agric.*, xxxi, 2, pp. 87–97, 2 figs., 1947.

In reciprocal transmission experiments on abacá [*Musa textilis*] with the [abacá] bunchy top [*R.A.M.*, xxvii, p. 21] and [cucumber] mosaic viruses [ibid., xx, p. 65], infection was readily obtained and the two diseases could easily be recognized in the same plant. The bunchy top virus can be extracted by *Pentalonia nigronervosa* from a plant harbouring both diseases and transmitted to healthy abacá, and likewise the mosaic virus by its vector, *Aphis gossypii*. On the other hand, *P. nigronervosa* cannot transmit the mosaic virus or *A. gossypii* that of bunchy top. The examination of cross-sections of abacá leaves showed that *P. nigronervosa* inserts its stylet either through the stomata or directly through the epidermis, piercing the tissue either inter- or intracellularly on its way to the phloem. The sheath or coating of salivary material formed by the insects round the stylets, as described by Tate (*Iowa St. Coll. J. Sci.*, xi, pp. 185–206, 8 pl., 1937), turns reddish on staining with safranin A and counter-staining with gentian violet. *P. nigronervosa* proved capable of conveying the bunchy top virus through abacá seedling roots, but the incubation period was longer (up to six weeks or so) than in the pseudo-stem or foliage, and this mode of transmission is unlikely to be of any importance in the field.

Nicolas (G.) & Aggéry [Berthe]. **Une maladie bactérienne du Cyclamen de Perse (deuxième note).** [A bacterial disease of the Persian Cyclamen (second note).] —*Bull. Soc. Hist. nat. Toulouse*, lxxvi, pp. 49–52, 1941. [Received 1947.]

Particulars are given of successful inoculation experiments on healthy Persian cyclamen [*Cyclamen persicum*] leaves with cultures of the bacterium previously described [*R.A.M.*, xvi, p. 466]. The results clearly demonstrate the responsibility of the organism for the symptoms observed. It probably originates in the soil and penetrates the leaves through the stomata on the lower surface, developing more or less rapidly according to the temperature of the hothouse, with an optimum round about 20° C.

Good (H. M.). **Studies on the Cladosporium blight of Sweet Pea.**—*Canad. J. Res.*, Sect. C., xxv, 5, pp. 137–154, 1 pl., 6 figs., 1 graph, 1947.

During 1945 a blight [white mould] of the sweet pea caused by *Cladosporium* [*Hyalodendron*] *album* [? *Erostrotheca multiformis*: *R.A.M.*, viii, p. 175; xxiii, p. 409], already reported from the United States [ibid., ix, p. 629], Europe [ibid., xvii, p. 587], Western Canada, and East Africa, was found for the first time in Ontario.

In a moist chamber at 25° C. the characteristic flecks appeared on the leaves in four to five days, high humidity favouring the development of the disease. Little sporulation [ibid., iii, p. 651] was observed on plants grown in the greenhouse under winter conditions. Disease development was more extensive in adult than in seedling leaves, as the latter are shed soon after inoculation and show no further sporulation. In Ontario, both spring- and summer-flowering types were attacked equally severely.

The fungus sporulated best on maize meal agar, growing normally from 5° to 30° with an optimum of about 25°. After two days at this temperature growth on the leaves was extensive, penetrations of the epidermis were noted, and after five days macroscopic symptoms of the disease appeared. Good colony development and germ-tube growth was obtained within pH 4 to 8, with a maximum at pH 6. After six months *C. album* became somewhat unstable in culture and three distinct morphological types, one forming microsclerotia and one sterile, were obtained, there being no difference in their pathogenicity although the sterile one did not fructify normally in the plant. The principal types of spore found in culture were (1) the usually unicellular, oval *Cladosporium* spores, borne in branched chains and measuring 3 to 16 by 3 to 5 $\mu$, and (2) very small spores occurring sporadically, submerged in one-month-old cultures, 1 to 1·5 by 2 to 5 $\mu$, borne singly or in groups, usually on branched conidiophores in association with dark microsclerotia. Although these features suggested that the fungus was an Ascomycete, no perfect state was obtained.

After a comparison made between the *C. album* from Ontario and the description given by Martin and Charles of *E. multiformis* had revealed differences in the occurrence of spore forms, morphology and extent of growth in culture, and general appearance, the author considers it doubtful whether *E. multiformis* is the perfect state of *C. album*. The imperfect state has been retained in the genus *Cladosporium* as it was decided that a difference in colour alone is not sufficient to warrant its removal to *Hyalodendron* [ibid., xiv, p. 69].

High humidities (90 to 100 per cent.) were necessary for infection, development, and fruiting on the leaf. Conidiophores developed abundantly in dry air but only when the substratum was at maximum hydration, thus affording sufficient moisture for growth. In every case penetration was stomatal, without appressoria, and occurred ten times more frequently on leaves with open than on those with closed stomata. The germ-tubes of *C. album* show positive hydrotropism, and the fact that this is an important factor in penetration was demonstrated by an increased frequency in penetration corresponding with an increasing humidity gradient around the stomata. In inoculation experiments penetrations were observed on the leaves of *Lathyrus latifolius*, lucerne, garden and sweet pea, and red clover, but no appreciable further development occurred in any but the sweet pea.

Jauch (Clotilde). **Una nueva enfermedad de las Calas en la Argentina, Coniothecium richardiae (Mercer) nov. comb.** [A new disease of Callas in Argentina, *Coniothecium richardiae* (Mercer) n.comb.]—*An. Soc. cient. Argent.*, cxliv, 3, pp. 447–456, 7 figs., 1947.

A fungus isolated from diseased calla (*Zantedeschia aethiopica*) plants at the Institute of Plant Hygiene, Ministry of Agriculture, Buenos Aires, presented the aspect of an *Alternaria* on potato dextrose solidified with agar and that of a *Phoma* on the same medium with carrageen as a substitute for agar. A mycological study was accordingly carried out to clarify the taxonomic position of the organism.

The lesions scattered over both leaf surfaces are greyish with a green or pale green central spot, becoming necrotic with a surrounding chlorotic halo. Originally measuring about 5 mm. in diameter, they gradually expand and turn light brown in the middle with concentric zones of the same colour shading into nearly black. At this stage they are oval to oblong and almost invariably cover a large part of the leaf-blade, reaching a minimum diameter of 10 cm. and often much more. The spots are frequently split or perforated, one part adhering to the edges while the other falls out. Quite a different foliar symptom was also observed, consisting of very pale green, water-soaked spots, crumbling between the fingers and after ten days becoming translucent and somewhat coriaceous. The spots on the petioles are similar to those on the leaves. They sink into the tissues until the petiole can no longer support the weight of the leaf-blade, bends over at the site of

infection, and finally breaks. The occasional spots on the stunted flowers are nearly always of a very bright chestnut colour and usually do not measure more than 1 cm. Naturally they are very conspicuous on the snow-white spathes, rendering them unfit for the market.

The pycnidia arising from the intracellular mycelium in the foliar and floral lesions are spherical, dark brown, 120 to 180 $\mu$ in diameter, furnished with thick walls and a circular ostiole, 20 to 30 $\mu$ in diameter. The oval, hyaline pycnospores measure 3 to 7 by 2 to 4 $\mu$. Intercalary or terminal dictyospores were occasionally observed in sections from herbarium specimens or spots kept for some time in a moist chamber. Both pycnidia and dictyospores were abundant on 2 per cent. potato dextrose with carrageen, malt agar, and Sabouraud's medium with agar, the former organs also on potato dextrose with difco and on carrots with agar or carrageen. On other media they were scanty or absent.

The typical symptoms of the disease were reproduced by inoculation of the leaves, petioles, and spathes with fragments of mycelium, and of the foliage with spore suspensions; the fungus was reisolated from the infected tissues.

The agent of the calla disease was first designated by Halsted in 1893 *Phyllosticta richardiae* and was renamed *Phoma richardiae* by W. B. Mercer in 1913 (*Mycol. Zbl.*, ii, p. 244); in 1932 Brooks erected a new species, *Phyllosticta richardiae*, on the grounds that the original name, lacking a diagnosis, was a *nomen nudum* [*R.A.M.*, xi, p. 517]. In the present writer's opinion the formation of intercalary or terminal dictyospores places the pathogen in the genus *Coniothecium*, as interpreted by M. H. Moore [ibid., xi, p. 50] and E. W. Mason (Annotated account of fungi received at the Imperial Mycological Institute, List II (fasc. 2), pp. 12–13, 1933). It is accordingly renamed *C. richardiae* (Mercer) n.comb.

Tompkins (C. M.) & Tucker (C. M.). **Stem rot of Dieffenbachia picta caused by Phytophthora palmivora and its control.**—*Phytopathology*, xxxvii, 12, pp. 868–874, 4 figs., 1947.

The causal organism of a stem rot of *Dieffenbachia picta* in San Francisco greenhouses, affecting both the ordinary, dark green type and the one with pale green foliage known as Rudolph Roers, was identified on the basis of its morphological, cultural, and physiological characters as *Phytophthora palmivora*. The symptoms of the disease include a rapid, wet decay of the stem at soil-level, yellowing and wilting of the leaves and petioles of young plants, and falling of the tops, followed by death. In older plants the foliage remains turgid and green even after lodging of the main stem.

Healthy plants grown from cane cuttings in the greenhouse in pots of steam-sterilized soil were infected by the application to the soil of malt extract agar cultures of the pathogen, the incubation period averaging 12½ days. Attempts to infect eight ornamentals failed and it is concluded that under local conditions the fungus is restricted to *D. picta*. The minimum, optimum, and maximum temperatures for the growth of the mycelium were found to be 18°, 28°, and 31° C., respectively.

The stem rot is favoured by high air temperatures, high humidity, poor soil drainage, excessive irrigation, and crowding of the potted plants in the greenhouse. It may be combated by the avoidance of these factors through rational methods of cultivation, supplemented by the rooting of cane cuttings, after dusting with fermate, phygon, or spergon, in small pots of steam-sterilized sand, and later transplanting them to larger pots of steam-sterilized soil.

Huber (G. A.) & Gould (C. J.). **Sclerotium delphinii Welch on Scilla.**—*Phytopathology*, xxxviii, 1, pp. 82–85, 1 fig., 1948.

Early in May, 1940, a commercial planting of *Scilla sibirica* near Tacoma, Washington, was largely destroyed by a disease involving foliar yellowing and

desiccation from the leaf tips downwards and wilting of the blossoms, the flower stalks remaining erect until the associated fungus had advanced well above soil-level. Infection apparently originated on the bulbs and thence spread to the aerial parts of the plant. Compact mycelial strands extended over the soil surface from the decayed foliage and flower stalks, and, in severely infected areas of the beds, from fragments of heavily contaminated leaves. Reddish- to dark-brown sclerotia were scattered over the surface and in the soil immediately surrounding the diseased plants, and were also detected in the rotten bulb tissues.

Platings were made on potato dextrose agar from bulbs in varying stages of infection from small, slightly sunken lesions to complete decay, as well as from the mycelial mats and strands on the soil surface, from sclerotia in the soil, and from diseased leaves and flower stalks. The cultures gave rise to white, non-sporulating mycelial mats producing reddish-brown sclerotia in 10 to 14 days. In a greenhouse test, out of 24 apparently sound bulbs planted 6 in. apart in sterilized silt soil mixed with a giant oat culture of the fungus six emerged, of which only one survived to form a flower stalk. All the decayed bulbs yielded the same fungus.

Bulbs planted in uninoculated sterilized soil developed normally and did not contract the disease. Of 100 externally healthy bulbs planted in inoculated soil in the field, four failed to emerge, having evidently begun to decay before the establishment of the root systems. Full bloom was reached by 22 per cent. of the plants. Five months later all but five of the bulbs examined bore lesions ranging from $\frac{1}{16}$ in. in diameter to total decay.

Dr. C. M. Coe, formerly of the Department of Plant Pathology, State College of Washington, identified the causal organism from cultures and partially rotted bulbs as *Sclerotium delphinii*. He found that the sclerotia of the *Scilla* fungus differed only slightly in size and colour from those of *Delphinium* isolates [*R.A.M.*, xix, p. 475], but suggested that an additional strain might be concerned in the case of the former host.

Dimock (A. W.) & Baker (K. F.). **Aspects of fungicidal control of Snapdragon rust.** —Abs. in *Phytopathology*, xxxviii, 1, p. 7, 1948.

Injury to snapdragons (*Antirrhinum majus*) from rust (*Puccinia antirrhini*) results from (1) a relatively benign host-parasite interaction, (2) desiccation of invaded areas, and (3) infiltration by secondary organisms, the type of damage depending on moisture conditions. With high inoculum potential the pathogen was not effectively combated by weekly applications of Bordeaux mixture (8–8–100 plus Du Pont spreader-sticker 1–1,000) either under humid conditions at Ithaca, New York, or in the semi-arid atmosphere of Los Angeles, California, but parzate [*R.A.M.*, xxvi, p. 472] (2 lb. per 100 gals. plus above-mentioned spreader) gave almost perfect control of rust, and consequently of secondary infection, without detriment to the host, in both localities. At Ithaca Bordeaux, by the quasi-complete elimination of secondary invaders, prevented defoliation and so imparted a vigorous appearance to the plants, but in the dry zone of California, where desiccation is the predominant effect of the rust, the fungicide failed to confer protection. These observations may explain the reported efficacy of Bordeaux against *P. antirrhini* in the damp climates of England and British Columbia and its inadequacy for this purpose in the dry regions of the United States, Europe, and Egypt.

Black (L. M.). **Transmission of Clover club-leaf virus through the egg of its insect vector.**—Abs. in *Phytopathology*, xxxviii, 1, p. 2, 1948.

In experiments at the Rockefeller Institute, [Princeton, New Jersey], leafhoppers (*Agalliopsis novella*) carrying clover club-leaf virus (*Aureogenus clavifolium*) [*R.A.M.*, xxiii, p. 490] were allowed to deposit their eggs in Grimm lucerne plants. Later each of 30 nymphs was removed immediately after hatching to prevent feeding on the plant in which the egg was laid, placed on a crimson clover seedling,

and transferred at weekly intervals to a fresh seedling until it died. Three insects died within a week, but the rest lived for 13 to 33 weeks. The clover test plants and an equal number of controls were grown in a greenhouse for at least six weeks after the removal of the insects. Of the 27 surviving insects, 24 (89 per cent.) transmitted the virus after a minimum period of three weeks from the time of hatching, with a maximum incidence from the 7th to 11th week. A total of 68 of the 642 test plants and none of the controls contracted infection. This is stated to be the second instance of the transmission of a plant virus through the egg of its insect vector.

THIRUMALACHAR (M. J.) & DICKSON (J. G.). **A Physoderma disease of Quack Grass.** —*Phytopathology*, xxxvii, 12, pp. 885–888, 2 figs., 1947.

A species of *Physoderma* closely resembling *P. zeae-maydis* [*P. maydis*: *R.A.M.*, xxvi, p. 357], but having non-erumpent sori and sporangia measuring 20 to 40 by 20 to 34 as against 18 to 24 by 20 to 30 $\mu$, has been observed on *Agropyron repens* in Wisconsin. The symptoms induced by the fungus include shortening of the culm internodes, erect development of the leaf blades, rusty-brown stripes on the older leaves, and in severe cases, basal rotting of the culm and foliar wilting and desiccation. A similar disease has been described in Europe on several grasses of economic importance, but this appears to be the first record for North America of the fungus in question. The morphology of the pathogen on *A. repens* presents affinities with that of *P. graminis*, also reported on the same host (Kryptogamenflora der Mark Brandenburg, v, 1915), but the latter species forms sporangia in the root cortex, which was free from infection in the authors' specimens.

KREIZINGER (E. J.), FISCHER (G. W.), & LAW (A. G.). **Reaction of Mountain Brome and Canada Wild-Rye strains to head smut (Ustilago bullata).**—*J. agric. Res.*, lxxv, 3, pp. 105–111, 1947.

This is a full account of the testing of 14 accessions of mountain brome (*Bromus marginatus*) and 12 of Canada wild rye (*Elymus canadensis*) from several western States at the Washington (D.C.) Agricultural Experiment Station for susceptibility to races 5, 7, 9, and 12 of the head smut pathogen (*Ustilago bullata*) [*R.A.M.*, xxiv, p. 268; xxv, p. 386; and above, p. 231]. It is recommended that strains of *B. marginatus* should not be increased for seed or released for commercial production unless their complete reaction to *U. bullata* is known. The physiologic races already recognized may be only phenotypes, the component parts of which may be separated by the use of additional differential hosts or strains within a host species.

GÄUMANN (E.). **Zur Kenntnis der Rostpilzflora der südkalifornischen Wüste.** [Contribution to the knowledge of the rust fungus flora of the south Californian desert.]—*Ber. schweiz. bot. Ges.*, lvii, pp. 245–249, 1947.

On a brief visit in March, 1947, to the area of the south Californian desert adjoining the Mexican frontier, the author collected three new species of *Puccinia*, including *P. lupinicola* on *Lupinus benthami*.

The rust (stated to be the first record of a *Puccinia* on *Lupinus*) presents a remarkable appearance on its host, the old stems of which are covered with thick, dense, compact, very dark brown to black crusts, while the lateral shoots are often so thoroughly enveloped by the overgrowths that their development comes to a standstill and they stand off from the stem in the manner of ergots [*Claviceps* spp.]. The teleutospores, of which the crusts are composed, are ellipsoid, tapering to a point at the apex, rounded at the base, with a slight median constriction, 26 to 48 by 13 to 27 (mostly 33 to 40 by 19 to 22) $\mu$, rarely unicellular, with a smooth, chestnut-brown membrane markedly thickened at the apex (4 to 7 $\mu$) and a hyaline, persistent pedicel up to 140 $\mu$ in length.

Slykhuis (J. T.). **Studies on Fusarium culmorum blight of Crested Wheat and Brome Grass seedlings.**—*Canada. J. Res.*, Sect. C, xxv, 5, pp. 155–180, 8 graphs, 1947.

During an investigation into the cause of poor emergence and mortality of brome grass (*Bromus inermis*) and crested wheatgrass (*Agropyron cristatum*) seedlings in Saskatchewan and Ontario soils the pathogenic fungi isolated from the roots of the affected seedlings included *Fusarium culmorum* [*R.A.M.*, xx, p. 353; xxvii, p. 136], *F. arthrosporioides*, *F. equiseti*, *F. oxysporum*, *F. scirpi* var. *acuminatum*, *F. solani*, *Helminthosporium sativum* [loc. cit.], *Pythium debaryanum*, and *P. ultimum* [loc. cit.], all of which reduced emergence. The *P.* spp. caused some damping-off, some *F.* spp. caused wilting and death of the seedlings and often a brownish discoloration of the stem bases, while *H. sativum*, besides causing wilting and death of emerged seedlings, also produced dark lesions on the stem which caused stunting or even mortality.

More blight developed on brome grass seedlings from 1 per cent. *F. culmorum* sand-maize meal inoculum in sterilized soil than from 6 per cent. in unsterilized soil. The development of the fungus was optimum at 25° C. in sterilized soil. Seedling blight was also most severe in sterilized soil at temperatures near 25° provided that the soil was not too heavily infected. In unsterilized soil, however, both the optimum development of *F. culmorum* and the most frequent incidence of seedling blight occurred at 10° to 20°, while other soil fungi and bacteria flourished at 25° and higher.

An infusion of unsterilized soil, a suspension of various soil bacteria, and a mixture of 75 soil fungi all retarded the growth of *F. culmorum* in sterilized soil and reduced the incidence of seedling blight. Out of 136 soil fungi tested only isolates of an *Acremonium* sp., *Gliocladium fimbriatum* [cf. above, p. 228], and a *Phialophora* sp. reduced blight in sterilized soil, this antagonistic ability being related to their effect on the development of *F. culmorum* in the environment in the immediate vicinity of the germinating seeds. Within this zone or spermatosphere the germinating seed induces a characteristic change in the microbiological balance. Disease incidence was more severe in uniformly infected unsterilized clay soils than in those of lighter texture. A correlation was found to exist between the suppression of blight and the numbers of bacteria in the spermatosphere.

Favard (P.). **Sur trois champignons parasites du verger.** [Concerning three parasitic fungi of orchards.]—*Progr. agric. vitic.*, cxxviii, 48, pp. 341–344, 1947.

Three destructive parasitic fungi, less familiar than the principal pathogens of orchard trees and often confused with them, are those causing bark [surface] canker of pear and apple (*Dermatea corticola*) [*Myxosporium corticola*: *R.A.M.*, iii, p. 405; x, p. 272], trunk rot of various trees (*Schizophyllum commune*) [ibid., xx, p. 433; xxiv, p. 383], and internal rot of pip fruits (*Coryneum foliicolum*) [ibid., xxv, p. 398]. *M. corticola*, which is particularly common in south-west France, usually induces slightly depressed, necrotic, cracked areas in the bark, encircled by more or less concentric, oval cracks running vertically. The pathogen gains entry through a wound or flaw on the younger branches, which frequently die after their bases or fruit buds have been encircled by the cankers. Eventually cankers appear on the trunk as well as the branches. Methods of suppressing the disease include the destruction of affected parts at the appearance of the disease and treatment of the resulting wounds with coal tar, creosote, or any other appropriate wound disinfectant.

*S. commune*, the chief cause of trunk rot and eventual death of pear, apple, horse-chestnut, ash, peach, and lime [*Tilia* spp.] trees, has been known to be the sole agent of the death of young trees. The pathogen enters through wounds

caused by other fungi or by borer attack. The mycelium spreads through the outer tissues, which assume a cankered appearance, into the wood, the latter becoming spongy and interwoven with whitish mycelium, resembling infection by *Armillaria mellea*. Observations made over a period of three years have shown that *S. commune* is usually fatal only to pear, horse-chestnut, and lime in the Gers area. When the affected trees are still young they can be saved by cutting out infected wood, including 2 or 3 cm. of the surrounding healthy zone, removal of affected branches, and immediate treatment with copper sulphate (2 in 100), followed by a coat of coal tar, tar, creosote, or putty.

Apples are particularly subject to attack by *C. foliicolum* up to maturity, although pears and other pip fruits are also affected. The fungus enters by the peduncle and sometimes destroys as much as 40 or 50 per cent. of the harvest. It also appears on the leaves as round, reddish spots bearing pycnidia. Treatment with materials containing copper, as for scab [*Venturia inaequalis*: ibid., xxvi, pp. 32, 306], should prevent serious losses.

Yin (K. Y.). **Development and control of the stem canker of Macrophoma ring spot of Apples.**—Abs. in *J. agric. Ass. China, 1945, Suppl.* 50, pp. 27–28, 1945. [Received November, 1947.]

Serious damage has been caused by apple ring spot (*Macrophoma kuwatsu-kaii* Hara) in the Chengtu district of China. In 1942, 78·6 per cent. of the Grimes Golden crop was destroyed in storage and some 20 per cent. on the trees. The fungus also attacks the stems and leaves. No spores are produced on the brown, irregular, sometimes concentrically zonate lesions on the foliage, but the stem cankers harbour large numbers. In this site the mycelium may persist for over four years, penetrating into the cambium or even as far as the xylem.

The stem is entered through the lenticels, which rupture in mid-April, and new cankers begin to appear about a fortnight later. In the field active sporulation occurs when the temperature rises above 20° C. and the relative humidity is over 75 per cent., the corresponding points in the laboratory being 28° and 98·2 per cent., respectively. The distance of spore dispersal does not exceed 10 m., but the process is of long duration, continuing into the winter provided there is sufficient rainfall.

Varying degrees of success were obtained in experiments (still in progress at the time of writing) in the control of the ring spot by treatments with mixtures of formaldehyde-lime, zinc chloride-glycerol-alcohol, and mercuric chloride.

Levy (B. F. G.). **Suspected boron deficiency in Apples in Britain.**—*Rep. E. Malling Res. Sta., 1946*, pp. 95–98, 1946.

In 1936, 16 Northern Spy Apple trees at East Malling showing bitter pit were injected with boric acid and a nitrogen-phosphorus-potassium mixture. The symptoms consisted of surface pits (typical of bitter pit) [*R.A.M.*, xxvi, p. 454] and the treatment had apparently failed to control the disorder.

In 1937 no surface pits were present on the rather small crop but different symptoms were observed, quite distinct from bitter pit. When the fruit was peeled necrotic, dark brown areas, 1 to 2 mm. in diameter, were visible, sometimes 4 mm. below the skin, mostly in the calyx hemisphere.

Those affected apples, which had received boric acid or boric acid plus the mixture, together showed 28 per cent. of the disorder, as compared with 43·8 for the two non-boron treatments. There was little difference between those receiving nitrogen-phosphorus-potassium and those without it.

A statistical analysis showed a significant difference between the boron and non-boron treatments, indicating a reduction in the intensity of the disorder by the former. It is concluded that mild boron deficiency may occur in British apples, in which it had not previously been recorded.

Levy (B. F. G.). **Tree injection. I. The estimation of dosage in relation to tree size. II. Methods for overcoming resistance to absorption of liquids. III. Reinvigoration of debilitated trees.**—*Rep. E. Malling Res. Sta., 1946*, pp. 99–103, 3 graphs; pp. 104–106; pp. 107–112, 2 pl., 1946.

Attempts were made to determine whether tree size could be used as a reliable basis for estimating liquid injection dosages for routine application with minimum tree injury [*R.A.M.*, xviii, p. 539]. The results of experiments at East Malling in 1935, in which apple trees ranging in size from 1 to 300 sq. cm. cross-section of trunk were injected with a complete nutrient solution (0·5 or 1 per cent. total concentration), showed that the ratio between maximum safe doses for any two trees was about the same as that between the cross-sectional areas of their main stems, and that the maximum safe dose was approximately 0·5 gm. per sq. cm. cross-sectional area.

In further tests this method of dosage estimation proved very successful when applied to 132 Duchess' Favourite trees, which showed only negligible leaf scorch a few days after the injection. When injecting large numbers of trees the maximum safe dose (Roach's method) should first be established on a few trees, and the dose for the rest calculated in proportion to their cross-sectional areas of stem. For bush apple trees 0·5 gm. (total salt) per sq. cm. cross-sectional area for solutions of concentrations between 0·5 and 1 per cent. is recommended.

In the second paper three methods are described for inducing trees to absorb liquid injections satisfactorily (1) for tall trees, raising the reservoir to give a head of pressure; (2) using a force pump; (3) initial pumping followed by the usual injection method (recommended for bush trees). A method for measuring the rate of absorption during injection is described.

In the third paper is described an experiment carried out in July, 1937, on debilitated six-year-old Duchess' Favourite dwarf bushes growing on four plots (nil, nitrogen, phosphorus, nitrogen-phosphorus) that had received no potash for 10 years. Many trees showed leaf scorch and most of the shoots were dying back into the old wood; the few fresh shoots stopped growing by July. The flowers showed 'ghost blossom' symptoms. A nutrient solution of 0·5 per cent. total salt concentration (urea 0·125, potassium sulphate 0·125, and potassium dihydrogen phosphate 0·25 per cent.) was injected into 128 trees, the dosage for each tree being calculated from its girth. An inspection of the trees after more than a year revealed that the injected trees had 10 per cent. less scorch than uninjected controls. The maximum reduction of 20 per cent. occurred on the unfertilized and nitrogen plots, the other two showing only 4 per cent. reduction. Die-back, recorded in March and June, 1938, was reduced to nil in 25 of the 30 injected trees, whereas the uninjected showed an increase from 27 to 42 trees with the disorder.

In 1937, before injection, nearly half the trees showed 'ghost blossoms'. In May, 1938, only eight of the 61 injected trees showed the symptoms as against 29 out of 55 of the untreated. A month after injection the treated trees bore 12½ times as many growing shoots as the controls, and by the spring of 1938 had produced fewer fruit buds but many more wood buds than the controls. They also had considerably more wood growth in 1938 than in 1937.

Although no final conclusions can be drawn from the experiment, it indicates that midsummer injections may have a beneficial effect on potash-starved trees even when growth has practically ceased.

Moore (M. H.). **Apple rootstocks as an outdoor host for mass infection and fungicide testing.**—*Rep. E. Malling Res. Sta., 1946*, pp. 118–119, 1946.

The author suggests that unworked apple rootstocks would prove useful material for experimental mass infection with apple pathogens, e.g., *Venturia inaequalis*,

and for fungicide tests on a field scale. Such mass treatment would possibly give less precise results than laboratory and greenhouse tests, but on the other hand would permit more detailed observation than is possible in orchard trials. Vegetatively raised rootstocks root easily, can be multiplied rapidly, and produce a succession of annual shoots ideal for detailed observation. Those highly susceptible to scab should be selected and infection induced by natural means. In the course of preliminary experiments natural and other shelters were used to protect the stocks from drying winds and a fixed water-sprinkler system maintained the humidity essential for adequate infection. Scabbed leaves collected in autumn, kept until spring under natural conditions, and spread along the rows of rootstocks, proved to be the most effective method of inducing infection by the naturally ejected ascospores. The test fungicides were applied to randomized lengths of row prior to the distribution of the leaves. A similar method of mass infection has been successfully devised for apple canker (*Nectria galligena*) [*R.A.M.*, xxvii, p. 74] and investigations are in progress on control measures. Evidence has been obtained which indicates that rootstocks may also be useful for estimating the effect of nutrition on disease incidence.

Dunegan (J. C.). **The occurrence of Monilinia seaveri on English Morello Cherry.**— *Phytopathology*, xxxvii, 12, pp. 929–930, 1 fig., 1947.

During the last 17 years the writer has frequently observed *Monilinia* [or *Sclerotinia*] *seaveri* [cf. *R.A.M.*, vii, p. 744; xxv, p. 235] on wild cherry (*Prunus serotina*) leaves and fruit, besides acting as an agent of seedling blight of the same host in Arkansas [ibid., xix, p. 281]. In the spring of 1934, *S. seaveri* was found attacking one unripe fruit on an English Morello cherry (*P. cerasus*), and again in 1935 on immature fruit on a number of the trees, on both occasions during excessively rainy periods. The conidial masses of the fungus, closely adpressed to the surface of the fruit, were readily distinguishable in the field from the cushion-shaped pustules of the common brown rot pathogen, *M.* [*S.*] *fructicola*, which was present on other cherries on the same trees. Another characteristic feature of *S. seaveri* was the sweetish odour emanating from the diseased fruits.

Van Koot (Y.). **Verschillende oorzaken van afsterving van Perziken en Pruinen onder glas.** [Various causes of dying-off of Peaches and Plums under glass.]— *Meded. Direct. Tuinb., 1947*, November, pp. 619–634, 10 figs., 1947. [English summary.]

Physiological causes of the dying-off of glasshouse peach and plum trees in south Holland include 'suffocation' of the roots associated with poor soil structure, defective aeration, and surplus water, resulting in a shallow root system; and an unduly high concentration of salts, especially sodium chloride, introduced into the soil with flood water. 'Suffocation' is well known in the Alicante vine as 'Alicante disease'.

Root rots of peach and plum are caused by *Armillaria mellea* and *Pholiota squarrosa* [*R.A.M.*, xviii, p. 360]. A typical symptom of infection by *Verticillium dahliae* is the brown ring in the xylem of the stem base. *Pseudomonas morsprunorum* and *P. prunicola* [ibid., xxv, p. 564] are wound parasites penetrating, for example, through the grafting scar and causing die-back, the former invading large branches and the latter young shoots: a brown ring develops in the cortex. Another form of branch die-back, involving sectors of the wood and bark, is probably due to species of *Phomopsis* and *Cytospora*. In such cases the symptoms are reminiscent of those of 'dead arm' of the vine (*P.* sp.), described by Mulder as occurring in Dutch hothouses [ibid., xxvi, p. 95]. Besides causing shot hole of the leaves, *Clasterosporium carpophilum* is the agent of 'water canker', the name applied to elliptical, dark-coloured areas which develop round the buds, especially

those of shoots with insufficiently matured wood, due to an excess of nitrogen and a high soil moisture content. *Stereum purpureum* [ibid., xxvii, p. 75] generally occurs on dry soils inadequately supplied with potash and nitrogen.

Biraghi (A.). **Il 'mosaico' del Mandorlo è prodotto da un 'virus'.** [Almond mosaic is caused by a 'virus'.]—Reprinted from *Risvegl. agric.*, *1947*, 13-14, 3 pp., 2 figs., 1947.

The author gives a full description of the mosaic symptoms observed on numerous almond trees at Bari [*R.A.M.*, xxvi, p. 113]. Some varieties were unaffected, while among the susceptible ones Montrone was severely attacked at Andria, whereas Fra Giulio, Occhio Rosso, Mandorla di Canosa, Spineta, Santoro, and Mandorla Bianca were less affected; Tuono was attacked only mildly, though at Barletta it showed distinct symptoms. At Noicattaro, Bianca, Belerda, and Noce were very severely affected, while Giotta and Nocella were less so. At Bari, Cristomorto and Montrone were attacked.

As regards the economic importance of the disease, it was observed that affected trees gave a smaller yield than healthy ones. The author advises that susceptible varieties should not be used in making new plantings. In areas where the disease has not yet appeared, trees and grafting material (even of apparently resistant varieties) obtained from localities where the condition is prevalent should on no account be used.

Demaree (J. B.). **Thelephora terrestris on Blueberry plants.**—*Phytopathology*, xxxvii, 12, pp. 930–931, 1 fig., 1947.

In November, 1946, *Thelephora terrestris* (also known as *T. laciniata*), the agent of smothering or strangling of conifer seedlings [*R.A.M.*, xviii, p. 490], was observed, apparently for the first time, on one-year-old blueberry (*Vaccinium australe*) plants in a New Jersey nursery on poorly drained, sandy, virgin soil. The fruit bodies of the fungus, 1 to 2 in. in diameter, were loosely attached to the stems, at and just below soil-level, of some two dozen plants covering an area of 20 sq. ft. adjacent to uncleared land. There was no sign of injury except to some leaves in contact with the soil which had died and been shed.

Chowdhury (S.). **A Glomerella fruit rot of Nuna.**—*Curr. Sci.*, xvi, 12, p. 384, 1 fig., 1947.

*Glomerella cingulata* was isolated for the first time from rotted 'nuna' (*Anona* [*Annona*] *reticulata*) fruits in the Sylhet district of Assam in December, 1944, since when the fungus has caused substantial losses. In the orchard where the attack was originally observed some 15 to 20 per cent. of the fruits were involved. Infection usually begins at the blossom end in the form of a dry, blackish-brown spot, which very slowly spreads in all directions and generally covers the entire fruit, transforming it into a shrivelled mass. Diseased fruits may cling to the tree or fall to the ground. The morphological and cultural characters of the pathogen are briefly described. Its pathogenicity was established by laboratory and field experiments on sound fruits. The rot was effectively combated in 1945 and 1946 by the application of 2–2–50 Bordeaux mixture to the fruits just before the usual time of its occurrence (mid- or late December) or immediately the initial symptoms were observed.

Modlibowska (Irena). **'Green blotch', an abnormal tissue of Apple fruits, probably associated with spring frost.**—*Rep. E. Malling Res. Sta.*, *1946*, pp. 62–65, 2 pl., 1946.

In autumn, 1945, at East Malling, dark-green sunken areas at the calyx end were observed on fruits of different apple varieties. Sometimes they appeared singly,

but usually formed a broken ring about 0·5 cm. wide and 4 to 5 cm. in diameter with the eye in the centre. As the fruit ripened the blotches remained green and sank deeper, but there was no distortion. The symptoms are somewhat similar to those caused by frost injury to young apples described by Rose *et al.* [*R.A.M.*, xiv, p. 450]. The author proposes to name the abnormality 'green blotch'.

Ellison's Orange was the most heavily affected variety, 65 per cent. of the fruit at East Malling, and several samples from other parts of the country (at the Royal Horticultural Society show in 1945), showing the disorder. Aromatic Russet, Barnack Beauty, Hubbardstone Nonsuch, and Ohinemuri were affected to a medium extent. Out of 195 varieties examined in 1945, 27 showed green blotch, 9 radial cracks, and 6 frost rings [ibid., xxv, p. 347]. Devonshire Quarrenden, Diamond, Gravenstein, Onyx, Pearl, and The Premier were heavily affected with radial cracks, while Early Victoria showed the most frost rings (medium).

In 1946 only a few fruits of Ellison's Orange, Rival, and Wagner showed green blotches at East Malling, but Ellison's Orange and Charles Eyre from elsewhere showed the characteristic symptoms.

Histological examination of the green blotch areas disclosed a greenish-white, spongy, irregular, entangled tissue with large air space underneath the epidermis and the four or five hypodermal layers. It consisted of elongated cells with thick, hyaline, external and thin internal walls. They divided cross-wise, forming branching, hypha-like threads. The cells close to the skin contained much chlorophyll. The tissue differed markedly from the normal callusing following frost cracking. A similar tissue was found in 1946 in fruitlets developed from artificially frozen flowers of Sunset and McIntosh Red.

It is concluded that green blotch originates from an internal crack in the cortex, which can be caused by frost.

Hutton (K. E.). **Brown rot of stone fruits.**—*Agric. Gaz. N.S.W.*, lviii, 9, pp. 487–491, 8 figs., 1947.

Brown rot of stone fruits (*Sclerotinia fructicola*) [*R.A.M.*, xxvi, p. 305; xxvii, p. 27] in New South Wales can destroy an entire crop. Most of the damage is due to the killing of the blossoms and the rotting of mature fruit. If the outbreak is serious the trees should be pruned in early autumn to remove dead and cankered shoots, and shaped for convenient spray applications. It is considered that routine control measures by orchard sanitation [ibid., xxi, p. 123] and spraying [ibid., xxiii, p. 167] should be adopted in all districts as a sound insurance policy against loss.

Harris (R. V.). **Plant pathology. A review of some recent research on virus diseases of Raspberry and Strawberry in Great Britain.**—*Rep. E. Malling Res. Sta., 1946*, pp. 113–117, 1946.

This study is a reprint of a lecture delivered to the Philosophical Society of Glasgow on 27th November, 1946, and deals with the degeneration of strawberry [*R.A.M.*, xxvii, p. 140] and raspberry varieties in Great Britain during the last 25 years and with the nature, analysis, and transmission of the responsible viruses and virus associations, most of which has been noticed from time to time in this *Review*.

One stock of a rogued Lloyd George raspberry selection (Amos Lloyd George), which had maintained exceptional vigour for some years, was found to be severely infected with mosaic 2 [ibid., xxvii, p. 141] when tested with Baumforth's B indicators. A number of the latter developed inconspicuous curling symptoms (distinct from leaf curl) without any mosaic mottling, but when transferred to symptomless Norfolk Giant, typical vein-clearing of mosaic 1 was produced. Mosaic 2 and this 'curly dwarf' together produced very distinct mosaic 2 symptoms, followed by rapid death in both Norfolk Giant and Baumforth's B. Evidently even

the best Lloyd George strains are infected with at least two viruses or virus groups. It is also concluded that both mosaic categories (1 and 2) are complex associations of viruses and that other non-expressing and as yet unidentified viruses are also responsible for the later stages of degeneration.

Cadman (unpublished work) has recently recorded some eight symptom types on the highly sensitive Norfolk Giant, one being Scottish leaf curl included in which is a characteristic blotch symptom. Some of these categories are complex in origin and apparently share viruses in common with other types.

De Carvalho (T.). **Fungicidas, bactericidas e correctivos de deficiências para tratamento das plantas.** [Fungicides, bactericides, and deficiency correctives for the treatment of plants.]—42 pp., 8 figs., Repartição Tecnica de Agricultura, Secção de Micologia, Mozambique, 1947. [Mimeographed.]

Comprised in this useful publication are exact instructions for the preparation of numerous plant-protectives, including some of recent development, and general recommendations for spraying and dusting.

Phillips (J. N.) & Vincent (J. M.). **Dosage/response relationships in mould inhibition.**—*Nature, Lond.*, clxi, 4084, pp. 210–211, 1 graph, 1948.

In this preliminary note the authors examine a formula expressing the inhibition of various moulds by alkyl *p*-hydroxybenzoates in relation to the concentration of the inhibitor and its agreement with the Langmuir adsorption isotherm. By the methods shown it becomes possible to examine dosage/response data in order to analyse inhibitory action in terms of biological adsorbability and relative effectiveness per unit area occupied by adsorbed molecules. The technique appears likely to be of use in the more critical study of toxic substances. The application of the method is illustrated in the case of the relative inhibitory action of successive alkyl *p*-aminobenzoates on *Byssochlamys fulva* [cf. *R.A.M.*, xxvi, p. 462; xxvii, p. 142].

Mondain-Monval (P.) & Bloy (J.). **Sur la constitution des bouillies bordelaises.** [On the constitution of Bordeaux mixtures.]—*C.R. Acad. Sci., Paris*, ccxxv, 2, pp. 122–123, 1 graph, 1947.

Plotting added copper sulphate against change in potential with a calomel [mercurous chloride] and a platinum electrode indicates the successive formation of three compounds, namely, $Cu(OH)_2$; $SO_3,10Cu(OH)_2$; $SO_3,4Cu(OH)_2$. The copper-sulphate solution (166·5 gm. per l.) was added to 200 ml. milk of lime (4·31 gm. as calcium oxide) at 15° [C.], stirring vigorously, at the rate of 0·5 c.c. every half-hour, except in the neighbourhood of the three flex points (14 to 21 c.c. added), where one hour was allowed between additions for equilibrium to be reached. Copper hydroxide gives a voluminous precipitate which settles rapidly with the cessation of stirring; it is at this point that the preparation of Bordeaux mixture is usually undertaken. Once the formation of $SO_3,10Cu(OH)_2$ begins, the mixture thickens appreciably and continues to do so until the precipitation of $SO_3,4Cu(OH)_2$ is complete, when a period of 12 hours is required for settlement. The replacement of calcium by strontium gives the same potentiometric curve, with much more rapid attainment of equilibrium, and the identical sequence of precipitation of the hydroxide and the two basic sulphates.

Yarwood (C. E.). **The fungicidal value of mixtures of lime sulphur and zinc sulphate.**—*Phytopathology*, xxxvii, 11, pp. 852–853, 1 graph, 1947.

Heuberger's discovery (abs. in *Phytopathology*, xxxvi, pp. 685–686, 1946) that the addition of zinc sulphate enhances the fungicidal efficiency of dithane

(disodium ethylene bisdithiocarbamate) suggested the possibility of a similar result from the admixture of the former compound with lime-sulphur. A series of concentrations of zinc sulphate (0 to 0·8 per cent.) was added to a series of concentrations of lime-sulphur (0 to 0·6) and the mixtures tested as eradicant and protective sprays on a number of plants with various diseases by methods previously described [*R.A.M.*, xxiii, p. 182]. Data were plotted as lime-sulphur dosage against percentage of disease control, and the amount of the compound required for 95 per cent. control with each concentration of zinc sulphate was determined. The maximum degree of synergism observed was in 15 greenhouse tests with bean [*Phaseolus vulgaris*] rust [*Uromyces appendiculatus*], in which the average LD 95 for lime-sulphur alone was 0·06 per cent. concentration of applied spray compared with 0·01 per cent. with the addition of 0·1 per cent. zinc sulphate.

Other uses in which zinc sulphate and lime-sulphur mixtures have proved more fungicidal than expected on the basis of additive action were as eradicants for bean rust and protectants against bean powdery mildew [*Erysiphe polygoni*], hop downy mildew [*Pseudoperonospora humuli*], and snapdragon [*Antirrhinum majus*] rust [*Puccinia antirrhini*].

Iron sulphate and copper sulphate were also tested separately as adjuvants to lime-sulphur and dithane. All combinations were synergistic for bean rust, though none to the same extent as zinc sulphate. However, as a protectant and eradicant for *E. polygoni* on bean and cucumber powdery mildew [*Pseudoperonospora cubensis*], the combination of iron sulphate and lime-sulphur may have been equally effective with the zinc sulphate–lime-sulphur mixture.

Rademacher (B.). **Übersicht über die resistenten deutschen Zuchtsorten der wichtigsten landwirtschaftlichen Kulturgewächse.** [Survey of the resistant German selected varieties of the leading agricultural crops.]—*NachrBl. dtsch. PflSchDienst*, N.F., i, 5–6, pp. 81–87, 1947.

One of the most pressing tasks in the reorganization of German Agriculture is the resumption of the plant-breeding studies interrupted by the military collapse and its consequences. In this connexion documented lists are given of pest- and disease-resistant varieties of cereals, potatoes, beets and swedes, colza and rape, various legumes, flax, and grasses resulting from over 20 years' selection work in Germany. A bibliography of 71 titles is appended.

Polunin (N.), Pady (S. M.), & Kelly (C. D.). **Arctic aerobiology.**—*Nature, Lond.*, clx, 4077, pp. 876–877, 1 map, 1947.

During Arctic survey flights over the North-west Territories, Canada, in August and September, 1947 [*R.A.M.*, xiv, p. 461; xxiii, p. 139], 51 Petri plates (with Czapek agar without sugar plus 1 gm. yeast extract per 1,000 c.c.) and 52 vaselined glass slides were each exposed for two and five minutes, respectively, against the air current. Preliminary examination has shown that plates exposed in the far north over the icefields of M'Clintock Channel bore numerous and varied colonies of fungi and bacteria. Full results and determinations may be expected in due course.

Preston (D. A.). **Host index of Oklahoma plant diseases, Supplement, 1947.**—*Tech. Bull. Okla. agric. Exp. Sta.* T–21 (*Suppl.*), 39 pp., 1947.

This supplement contains information on the occurrence and distribution of 331 additional plant diseases recorded in Oklahoma since the publication in 1945 of the author's host index of local plant diseases [*R.A.M.*, xxv, p. 75], bringing the total number up to 2,441. The record of peach yellows [virus] given in the earlier publication should be deleted.

Wade (G. C.). **The fungicidal action of propylene glycol aerosol, and its use as an aid to pure culture technique.**—*Aust. J. exp. Biol. med. Sci.*, xxv, 2, pp. 179–182, 1 fig., 1 graph, 1947.

At the Plant Research Laboratories, Department of Agriculture, Victoria, propylene glycol aerosol [cf. *R.A.M.*, xxv, pp. 4, 464] proved to be fungicidal to mould (*Aspergillus niger* and *Penicillium* sp.) spores suspended in air, but not to large masses. Its efficiency was not affected by the relative humidity of the atmosphere at concentrations of 50 and 100 per cent. The compound is not a powerful fungicide when used in solution, concentrations of 12 and 6 per cent., respectively, being necessary for complete inhibition of growth of *A. niger* and *Sclerotinia fructicola*.

Propylene glycol has several advantages as an air sterilizant in rooms or transfer chambers where pure-culture work is in progress, being odourless, non-irritant, and devoid of adverse effects on the experimental micro-organisms. A period of about 15 minutes is requisite for the sterilization of a heavily contaminated atmosphere by glycol at a concentration of 1 gm. in 3,000,000 ml. air.

Corner (E. J. H.). **Variation in the size and shape of spores, basidia and cystidia in Basidiomycetes.**—*New Phytol.*, xlvi, 2, pp. 195–228, 4 figs., 14 graphs, 1947.

After stating that the classification of species of Basidiomycetes according to spore shape and their separation according to spore size seems to him unnatural, the author presents the results of his study of groups of very closely related species. These results suggest that there is a fundamental law of hyphal growth and that a general relation exists between length ($D$) and width ($d$) of basidiospores (excluding the apiculus) which can be expressed as $D = d(a+bD)$. The method of obtaining values for the constants $a$ and $b$ is given and the types of growth corresponding to different values of $a$ and $b$ are illustrated by graphs.

The method adopted is to group the sizes of mature spores from fresh spore prints according to differences in length. When possible, 20 spores are measured for each value of $D$. Since the first spores to be seen in the appropriate position are measured, the sampling is random, but it is always necessary to search for spores at the upper and lower limits of $D$. The measurements are arranged in order of increasing values of $D$ and, when $D$ is the same, in increasing values of $d$. The data are then averaged for convenient ranges of $D$ and the averages from these tabular analyses are the 'working data' for the graphical analyses.

The working data consist of $D$, $d$, and $E$, which is the ratio of $D:d$ and expresses the shape or elongation of the spore (in the common, not the mathematical, sense of ellipticity). Thus, if $E$ is unity, the spore is globose, and as $E$ increases the spore elongates parallel with the long axis of the basidium; only in very young spores is $E$ less than unity. The use of this ratio led to the discovery that the graph relating $E$ and $D$ for any one species can be idealized as a straight line and is termed a 'sporograph'. Its cotangent represents the maximum width attainable by that kind of spore.

The locus of the working data is the 'species-locus' or, if idealized, the 'species-line'. A generic sporograph may be made to compare the different species lines and it will show the different kinds of spores in the genus with their different manners of growth.

The measurements are averaged because personal errors are unavoidable, because the spores are not exactly elliptical in optical section but are always flattened on the adaxial side, and because the width in the sagittal plane (the one taken by the author as being most easily identified) may be appreciably less than in the tangential one at right angles, and it is often difficult to be sure that the spore lies exactly in the sagittal plane. There is also a normal fluctuation in $d$ for a given value of $D$.

The sporograph should show a species-band rather than a species-line, but the determination of the limits of a band requires many more data than for its direction, which is all that initial analysis requires.

A further datum is the 'species-point'. In order to use the many accurate spore measurements published the author has taken the mean values of $D$ and $d$ from these measurements to obtain a mean value of $E$. He found that the mean values approximate closely to the average if the extremes have been fairly estimated. A five-minute inspection of a slide will give extremes from which the mean value of $E$ obtained will differ only in the second decimal place from an average obtained after several hours of exact measurement. The very shortest, longest, fattest, and leanest spores can be used, as they generally give the best mean values. To specify a locus the author uses the notation $D:E–D':E'$ which makes it possible to rule a line quickly for reference when details are not required.

The author defines spores of the same kind as those conforming to the same locus on the sporograph, as well as agreeing in other generic features. They need not have the same shape or size. Spores of the same size have the same dimensions but are not necessarily of the same kind. Spores of the same shape have the same value of $E$ but may differ in size and kind. Spores of closely allied species conform to the same locus. Spores of different kinds have distinguishable loci defined by the values of the constants $a$ and $b$. Examples are given from *Clavaria*, *Typhula*, *Boletus*, and *Hygrophorus* spp.

A study of the data for length and width of the basidia of *Clavaria*, *Oudemansiella* (= *Collybia* p.p.), *Amauroderma*, and *Ganoderma* showed that the same relation holds for the basidium. Generic and family kinds of basidia can be analysed in the same way by means of the basidiograph and can be defined by the same constants $a$ and $b$. The cystidia of *Clavaria* and *Oudemansiella* conform to the same equations as their basidia, and can be regarded as sterile and mostly precocious and overgrown basidia.

This relation between length and width expresses the characteristic of hyphal growth as a hyperbolic elongation to a limiting width. Such curves, relating length and width, are morphological expressions of fungi, both micro- and macroscopic.

Stansly (P. G.). **A bacterial spray apparatus useful in searching for antibiotic-producing microorganisms.**—*J. Bact.*, liv, 4, pp. 443–445, 1 fig., 1947.

A description is given of an easily manipulated spray apparatus for the uniform inoculation of agar plates with bacterial test organisms in antibiotic assays [cf. *R.A.M.*, xxvii, p. 145].

Conner (J. W.). **Microorganisms and foods. Part II.**—*Canad. Food Packer*, xviii, 3, pp. 19–21, 23, 25, 11 figs., 1947.

This is a popular account of the part played by moulds and yeasts in food spoilage The organisms discussed are *Rhizopus nigricans* [*R. stolonifer*] on bread, stored sweet potatoes, strawberries (causing watery rot or 'leak' [*R.A.M.*, xix, p. 26]), and butter; *Mucor mucedo* on bread, fruit, etc.; *Aspergillus glaucus*, *A. flavus*, and *A. oryzae* on nut meats; *A. niger* on onions; *Penicillium* spp. on bread, frozen meat, cheese, and dairy products generally, citrus, various fruits, and a number of other common foods; *Trichothecium roseum* on decaying fruit; *Cladosporium herbarum* on rubber, leather, textiles, foodstuffs (including refrigerated meats), and decaying vegetable matter; *Oidium* [*Oospora*] *lactis* on sour milk and butter and *Oidium citri* [*Oospora citri-aurantii*] on lemons in California; *Sporotrichum carnis*, producing white, woolly patches on frozen beef [ibid. iii, p. 52; xix, p. 152]; *Fusarium* spp. on vegetables and cheese; *Botrytis cinerea* on strawberries (even under refrigeration), hops, and frozen meats; *Saccharomyces pastorianus*, which imparts a disagreeable flavour and unpleasant odour to beer;

*Torula* spp., responsible for damage to many kinds of food, including sauerkraut, oysters and codfish, molasses, syrups, and honey [cf. ibid., xxv, p. 74]; *S.* and *Zygosaccharomyces* spp. on maple syrup and honey; *T. cremonis* and *T. sphaerica*, inducing a gaseous fermentation of canned concentrated milk and a 'yeasty' flavour in butter; *T.*, *Willia*, and *Z.* spp., concerned in the 'souring' of figs, dates, and prunes [ibid., xxvi, p. 66]; and *Mycoderma* spp. on pickles and olives. Paramount importance in the control of microbiological spoilage is attached to strict sanitation in the plant, prompt handling of raw foods, and properly supervised processing.

Vicklund (R. E.) & Manowitz (M.). **Test methods for evaluating paint fungicides.** —*Amer. Paint J.*, xxxii, 10, pp. 67–68, 70, 72, 75, 78, 80, 82, 86–89, 5 figs., 1947.

Several methods for determining the resistance of paints to mildew [*R.A.M.*, xxvi, p. 558] having proved unsatisfactory at the Engineers Research and Development Laboratories, Fort Belvoir, Virginia, the following procedure was devised and found to give reproducible test results in a week to ten days in a tropical environment. No. 30 Whatman filter paper is impregnated with the test paint, dried for 48 hours, marked, and cut into $1\frac{1}{4}$ in. squares, which are placed on a synthetic nutrient medium in Petri dishes, inoculated with *Aspergillus niger* and *A. oryzae*, and incubated at 28° to 30° C. and a relative humidity of 85 to 90 per cent. The fungicides are rated for efficiency according to a scale in which (1) represents no mould growth on any portion of the sample up to a guide line drawn with black waterproof ink $\frac{1}{8}$ in. from the edge; (2), (3), and (4), slight, moderate, and heavy mould growth, respectively, on any part of the sample within the guide lines. Careful selection of the wood panels for field exposure tests was found to be essential to avoid erroneous interpretations of the results due to differences in the susceptibility of heartwood and sapwood and similar variable factors.

Kanagy (J. R.), Charles (Arbelia M.), & Abrams (E.). **Development of a fungicidal dressing for leather.**—*J. Amer. Leath. Chem. Ass.*, xliii, 1, pp. 14–31, 1948.

A tabulated account is given of the results of co-operative tests at the National Bureau of Standards, Washington, D.C., the University of Cincinnati, and at laboratories of the Department of Agriculture in Philadelphia and at Beltsville, Maryland, on the relative efficiency of a number of fungicides against leather moulds [*R.A.M.*, xxvii, p. 191 and next abstracts], including *Aspergillus niger* (the specific test organism of the Bureau of Standards), and *Penicillium* No. 15, *A.* Nos. 2 and 11, and *A. terreus* (used at Beltsville) [cf. ibid., xxv, p. 410]. Pentachlorophenol and paranitrophenol were found to be the most effective of all the compounds included in the experiments and on this basis the following formula is recommended as a suitable dressing, at a strength of 5 per cent., to maintain serviceability and prevent mildew growth on articles not coming into direct contact with the skin: 2 per cent. (by weight) each of paranitrophenol and pentachlorophenol, 10 per cent. each of light mineral oil, neatsfoot oil, and cyclohexanone, and 66 per cent. perchloroethylene.

Prendergast (A. G.). **The use of organo-mercurial compounds to control mould growth in leather.**—*J. int. Soc. Leath. Chem.*, xxxi, 4, pp. 143–153, 1947.

The author tested a number of organo-mercurial compounds for the control of moulds (*Penicillium* and *Aspergillus* spp.) on leather [see preceding and next abstracts] with very promising results, notably in the case of phenyl mercuric borate, with which extended trials were carried out under very exacting conditions of high relative humidity, heavy initial inoculation, and continuous abundant spore infection throughout the experimental period. Applied at a concentration of 0·01 per cent. in aqueous solution or fat liquor emulsion, the compound conferred

effective protection. Phenyl mercuric stearate, incorporated in the fat liquor at 0·016 per cent., also proved reasonably efficient. The mercurials were not removed by soaking the treated leather in water for 24 hours.

COLIN-RUSS (A.). **The control of mould growth and mustiness in leather and fabric materials.**—*J. int. Soc. Leath. Chem.*, xxxi, 12, pp. 403–407, 1 graph, 1947.

In this paper, presented at the 11th International Congress of Pure and Applied Chemistry, London, July, 1947, the author briefly discusses the significance of associated moisture in relation to mould growth on leather [see preceding abstracts], points out some difficulties of inoculum standardization, lists 37 fungi encountered by different workers all over the world in leather and shoe technology, and describes a standard procedure that has proved very serviceable during the last ten years for tests of antiseptics on fabric or leather cuttings and shoe components. It is conducted in a large tank on the principles leading to the cotangent vectorial percentage, i.e., the percentage of the conditioned weight of material which is associated moisture (*J. int. Soc. Leath. Chem.*, xxiv, p. 400, 1940; xxx, p. 179, 1946). The incubation is observed daily at 20° C. and saturation humidity; if no growth is present for 14 days, the aseptic state of the material under trial is deemed to be excellent. If growth starts after five days, an analysis is performed at the end of the fortnight's incubation to determine whether the growth is of the musty group or not, and an upper yield limit of 0·3 per cent. mould organisms, based on the conditioned weight of material, constitutes a 'hygienic pass', especially for leather shoe components and fabric linings. The following (in aqueous solution) were found to be effective for inhibition over a month's duration: 1 per cent. sodium silicofluoride, 1 per cent. chromium fluoride, and 2 per cent. sodium borofluoride, but phenyl mercuric nitrate in 0·00175 to 0·002 per cent. concentration (or the borate) [see preceding abstract], dissolved in aqueous diethylene glycol, is supreme on a price–efficiency basis.

PELTIER (G. L.) & BORCHERS (R.). **Riboflavin production by moulds.**—*J. Bact.*, liv, 4, pp. 519–520, 1947.

Out of 240 fungal isolates which produced riboflavin [*R.A.M.*, xxv, p. 354] on a wheat bran substratum, 45 (notably *Fusarium* and *Aspergillus* spp.) gave over 2 mgm. riboflavin per 100 gm. mould bran, the highest yield, obtained from a 'gold' *Aspergillus*, being 5·8 mgm. per 100 gm. It is concluded that some isolates produce riboflavin in amounts sufficient to warrant further study.

HERVEY (ANNETTE H.). **A survey of 500 Basidiomycetes for antibacterial activity.**—*Bull. Torrey. bot. Cl.*, lxxiv, 6, pp. 476–503, 3 figs., 1947.

Investigations of 508 isolations of Basidiomycetes [*R.A.M.*, xxvi, p. 556] showed that about 55 per cent. displayed anti-bacterial activity against *Staphylococcus aureus*. Forty-five isolations produced inhibition zones more than 10 mm. in diameter by the agar disk method. Culture fluids with activity of 64 dilution units or more were obtained from 16 isolations. *Trametes serpens*, further investigation of which is recommended, showed its greatest anti-bacterial activity (inhibition zones of 21 mm. diameter and activity of 64 to 128 dilution units) on a basal medium containing 1·5 gm. potassium dihydrogen phosphate, 0·5 gm. magnesium sulphate, 50 gm. dextrose, 2 gm. asparagine, 0·5 ml. mineral supplements, 12 ml. of a vitamin mixture, 6 $\gamma$ biotin, and 625 mgm. casein hydrolysate per l. (pH 5·8). Generally the greatest anti-bacterial activity was obtained on those media on which the fungus grew slowly. Several isolations of *Drosophila* [*Hypholoma*] *subatrata* and *Rhodopaxillus nudus* [*Tricholoma nudum*] produced culture fluids active at a dilution of 1,024 to 2,048.

Dulaney (E. L.). **Some aspects of penicillin production by Aspergillus nidulans.**—*Mycologia*, xxxix, 5, pp. 570–581, 1947.

The author gives a full account of his researches into penicillin production by a strain of *Aspergillus nidulans* [*R.A.M.*, xxiv, p. 282] isolated from compost. The organism produced penicillin in both surface and submerged fermentations, and the greatest yield obtained was in 4 per cent. maize steep with 2 per cent. lactose and was equivalent to 20 $\mu$/ml. of penicillin.

Dulaney (E. L.). **Penicillin production by the Aspergillus nidulans group.**—*Mycologia*, xxxix, 5, pp. 582–586, 1947.

A study of penicillin production by strains of *Aspergillus quadrilineatus*, *A. rugulosus*, and *A. nidulans* [see preceding abstract] indicated that metabolism solutions of species of the *A. nidulans* group characteristically contain antibiotic substances, although in small amounts, which appear to be closely related to penicillin.

Ainsworth (G. C.), Brown (Annie M.), Marsden (P. S. S. F.), Smith (P. A.), & Spilsbury (J. F.). **A method for the large-scale production of streptomycin by surface culture.**—*J. gen. Microbiol*, i, 3, pp. 335–343, 1 pl., 1947.

An account is given of a method of producing streptomycin by the surface culture of *Streptomyces griseus* [*R.A.M.*, xxvi, p. 312] in pint milk-bottles on a papain digest of beef+meat extract+glucose+mineral-salt medium. After 10 to 14 days' growth at 28° C. streptomycin titres in the crude culture filtrates of 250 $\mu$g/ml. or more were secured. Evans's peptone, papain digest of spent pancreas from insulin manufacture, papain digest of yeast, and a proprietary casein-meat hydrosylate were possible alternative sources of organic nitrogen. Glucose utilization and streptomycin production depended on the relative amount of nitrogen in the medium.

Gray (W. D.) & Martin (G. W.). **The growth of fungi on asphalt-treated paper.**—*Mycologia*, xxxix, 5, pp. 587–601, 7 figs., 1947.

The use of asphalt-coated paper to protect the contents of boxes from injury by moisture and moulds is very extensive. Nevertheless, general asphalt-treated L–2 type case liners have been found with mould spots, isolations from which yielded 19 different fungi. Studies were made, therefore, to ascertain whether materials of this nature obtained from various firms would support fungal growth. Those tested were finished case liner materials, kraft paper [*R.A.M.*, xxv, p. 354], both infusion and laminating asphalt, and crêped kraft paper treated with dowicide G (0·7 to 1·6 per cent.).

From the results obtained it is concluded that many fungi are able to grow on asphalt-treated paper or its component materials. Some of the fungi concerned were able to attack cellulose (as shown by loss of tensile strength of 12·29 oz. grey duck), while others seemed to be only surface-growers. One species of *Aspergillus* (of the *A. fumigatus* group) reduced the tensile strength of grey duck by 37·8 per cent. in one week.

Kraft paper treated with dowicide G effectively resisted fungal attack even when the concentration of the chemical was as low as 0·7 per cent. If a paper so treated were leached it then supported some fungal growth, but the fact that dowicide G can be leached out should not act as a deterrent to its use, as it is doubtful whether much, if any, could be leached out when the paper is coated with asphalt.

Asphalt-coated case-liner material prepared with treated paper and untreated asphalt was able to support fungal growth. Paper containing 1·6 per cent. dowicide G, infused with asphalt containing 3 per cent. pentachlorophenol [ibid., xxvi,

p. 254] was, however, entirely resistant to mildew (*Penicillium* spp. of the *fasciculata* group, *A.* sp. of the *versicolor* group, *A.* sp. of the *fumigatus* group, *A.* sp. of the *flavus-oryzae* group, *Chaetomium* sp., *Sepedonium* sp., and *Trichoderma* sp.). Untreated paper infused with treated asphalt was resistant to all the test fungi except the *Trichoderma*. Adding inhibitor to the asphalt only will, therefore, give a reasonable degree of mildew resistance, but this method is not recommended unless the paper is very thoroughly infused with the asphalt.

SANFORD (G. B.). **Effect of various soil supplements on the virulence and persistence of Rhizoctonia solani.**—*Sci. Agric.*, xxvii, 11, pp. 533–544, 2 figs., 1947.

This series of experiments, designed to ascertain the effect of certain soil amendments on the virulence of *Rhizoctonia* [*Corticium*] *solani* towards potato [*R.A.M.*, xxvii, p. 90] and its persistence in the field, was suggested by the results of earlier studies [cf. ibid., xx, p. 221]. In April of each year from 1937 to 1942 freshly cut Early Ohio potato sets (each weighing 10 gm. and of uniform shape) from clean, semi-dormant tubers stored at 2° C. were immersed for eight minutes in a 1 in 1,000 solution of mercuric chloride plus 1 per cent. by volume of hydrochloric acid and rinsed in tap-water. They were then planted in fresh, unsterilized Edmonton black virgin loam to which the pathogen and the amendments had been added 10 days earlier. The inoculum, consisting of a virulent culture of *C. solani* increased in steam-sterilized black loam, was used at the rate of one part in 15 parts of soil. Uniform infestation of the soil was secured by mixing and sifting, and each amendment then added to the required weight of soil. After 21 days the sprouts in the various containers were removed and rated for disease, the degree of massing of mycelium and formation of sclerotia on them being recorded also. The soil was then replanted immediately with fresh sets and again at the end of further 21-day periods up to six or eight times. In all the experiments the temperature was 16° to 17° and the soil water content about 30 per cent. of the water-holding capacity (both favourable to the disease).

The results obtained showed that nitrogenous salts, particularly nitrate and maize meal, tended to reduce the disease and also the persistence of the pathogen in the soil, whereas sucrose, calcium hydroxide, magnesium sulphate, and sulphur tended to favour both. In most instances sucrose favoured disease and persistence more than any other supplement. The effect of dextrose varied. Conditions for maximum virulence and persistence of the pathogen appeared to be most uniformly favourable in the natural soil plus inoculum but without any supplement (continuous control), virulence and persistence being maintained at a high level throughout the whole series of experiments.

The reduction of disease and the apparent decline of the pathogen are tentatively attributed to antibiotic effects of associated soil fungi and bacteria, as modified by certain of the treatments.

DAVIDSON (R. S.) & RICH (A. E.). **Performance of new fungicides for control of Potato late blight.**—Abs. in *Phytopathology*, xxxvii, 11, pp. 846–847, 1947.

Comparative tests to determine the relative efficiency of some new organic fungicides in potato blight [*Phytophthora infestans*] control were performed at the Rhode Island Agricultural Experiment Station in 1945 and 1946. None of the 12 synthetic organic materials used in 1945 equalled Bordeaux mixture for the end in view [*R.A.M.*, xxiv, p. 139], but phygon, fermate, dithane 14, and zerlate resulted in significantly higher yields than those obtained from the untreated plots. The fungicidal properties of seven of the foliar sprays were further investigated in 1946, when Bordeaux again proved superior to all the others. However, the yields from the plots treated with zerlate, phygon, and G–11 (di-trichloro-dihydroxy diphenyl methane) significantly exceeded those from the controls. In

both seasons the more effective of these sprays were less injurious to the foliage than those containing copper. Poor adhesion was apparently one of the reasons for the failure of the organic materials to control late blight. DDT was incorporated in all the treatments in both years, while in 1946 a check plot was included receiving that compound only. This plot showed no advantages over an untreated one, indicating that DDT is devoid of fungicidal properties. On the other hand, 9–11, similar in chemical composition to DDT, gave fair control of *P. infestans*.

Hashioka (Y.). **The mode of prevalence of Rice blast disease and the discussion on the control measure in the tropics.**—*Agric. Rep., Taiwan agric. Res. Inst.*, i, 4, pp. 9–11, 1947. [Chinese.]

The prevalence of rice blast [*Piricularia oryzae*] has been found to depend largely on the following four factors: (1) relation of temperature to the growth of the pathogen; (2) relation of temperature to the resistance of the host; (3) relation of age of plants to resistance; and (4) inherent varietal resistance [*R.A.M.*, xxvi, pp. 315, 466]. In the temperate regions (1) is the predominant factor in the development of infection, in the sub-temperate (1) and (3), in the subtropical all four are concerned, and in the tropical (1) and (4). Otherwise expressed, prevalence in the temperate zone is entirely controlled by a single factor related exclusively to the growth of the causal organism, while in the subtemperate another one also operates, namely, the age of the host. In the subtropical and tropical zones, on the other hand, factors associated with host resistance are of major importance in the determination of prevalence. In the two former regions, therefore, control measures should be based on the prevention of the development of *P. oryzae*, whereas in the two latter attention should be directed towards an increase of host resistance by hybridization.

Malowany (S. N.) & Newton (J. D.). **Studies on steam sterilization of soils. I. Some effects on physical, chemical, and biological properties.**—*Canad. J. Res.*, Sect. C, xxv, 6, pp. 189–208, 13 graphs, 1947.

This study describes investigations into the physical and chemico-biological changes in Alberta soils following steam sterilization and subsequent recontamination.

Crandall (B. S.). **Cinchona root disease caused by Phytophthora cinnamomi.**—*Phytopathology*, xxxvii, 12, pp. 928–929, 1947.

Apart from top die-back (*Phytophthora*) [*quininea*: *R.A.M.*, xxvi, p. 467], diseases were not troublesome in the Cinchona plantings at the Tingo María Agricultural Experiment Station, Peru, until an outbreak of rootlet rot caused by *P. cinnamomi* on one-year-old transplants of the Ledger form of *C. officinalis* in 15 beds of 100 ft. each at the height of the wet season of 1945–6. The initial symptom of foliar chlorosis was progressively followed by loss of all but the terminal leaves on the branches and main stem and within a month by death. The collar region and the larger roots were in good condition. The isolates of the species from *Cinchona* are indistinguishable from those of *P. cinnamomi* from avocado in the same region, but cross-inoculations were not performed. *Cinchona* seedlings contracted the disease only when inoculated under conditions of high soil moisture, *P. cinnamomi* has been reported as an agent of *Cinchona* root rot in Malaya [ibid., xx, p. 8], but this appears to be the first record of its occurrence on the host in question in the western hemisphere.

**Report of the Federal Experiment Station in Puerto Rico, 1946.**—55 pp., 1947.

In the section of this report [cf. *R.A.M.*, xxv, p. 545] dealing with agronomic studies on vanilla [*Vanilla fragrans*], greenhouse experiments conducted by

H. R. Cibes and N. F. Childers showed that phosphorus deficiency was next in importance to nitrogen deficiency in restricting growth. Minus-phosphorus plants closely resembled plants in the field succumbing apparently to root rot (*Fusarium batatatis* var. *vanillae*) [cf. ibid., xxiv, p. 494; xxvi, p. 146].

Lo (T. T.). **Two types of conidia and setae of Colletotrichum falcatum Went.** —*Sugarcane Res., Taiwan*, i, 2, pp. 19–23, 1947. [Chinese, with English summary.]

Two different types of conidia of *Colletotrichum falcatum* [*Physalospora tucumanensis*], the agent of red rot of sugar-cane, were detected at Pingtung, Formosa, and are herein designated strains A and B. The conidia of the former are narrower than those of the latter, the averages of 30 measurements being 30·2±3·179 by 5·41±0·465 and 20·21±2·12 by 7·17±0·57 $\mu$, respectively, while the setae of A are straight and longer (113·19±27·01 by 3·89±0·63) than those of B (62·48± 18·22 by 4·18±0·63) $\mu$ [cf. *R.A.M.*, xxvi, p. 144].

Van Dillewijn (C.). **Stalk population, yield composition and Fusarium top rot in Sugar Cane.**—*Sugar*, xliii, 1, pp. 28–30, 7 graphs, 1948.

The writer describes the results of one experiment out of a series initiated in 1932, recording the history of each stalk of the cane population of the estates on the North Java coast from the moment of its origination up to harvesting. The primary shoots were labelled and numbered, and their condition was investigated at monthly intervals, the secondary shoots that appeared in each of the subsequent months being similarly treated. When the stalks died, the month and the cause of mortality were registered. Each test comprised 10 rows 10 m. in length, with a space of 108 cm. between the rows.

The plot was planted with P.O.J. 2878 in the early days of July, when the primary shoots numbered 180, falling during the next three months to 140 and remaining practically constant at this figure. The September stalks started at 500, but only about 110 (20 per cent.) survived the heavy mortality of the next two months. Very few shoots were formed in October, none from November to March, and only some water shoots in April and May. The October mortality of 375 stalks represents over 30 per cent. of the total.

An analysis of the causes of mortality revealed 'lagging' as responsible for by far the greater part. This condition is characterized by a retardation of growth and shrivelling of the leaves, followed by a kind of dry top rot. In 1936 many of the stalks affected by 'lagging' were found to bear perithecia of *Gibberella* [*fujikuroi* ? var. *subglutinans*: *R.A.M.*, xiii, p. 686; cf. also xxvii, p. 44], the perfect state of *Fusarium moniliforme* var. *subglutinans*, which developed from ascospore cultures. Inoculations with ascospore suspensions resulted in the development of typical *Fusarium* symptoms. The importance of the 'lagging' stalks lies in the fact that they are carriers of the fungus, the perithecia of which discharge their ascospores at the beginning of the rainy season, when the plants are particularly susceptible to top rot.

**Dutch Elm disease quarantine (quarantine No. 70).**—*B.E.P.Q., U.S. Dep. Agric.*, 3 pp., 1947.

The detection of the Dutch elm disease (*Ceratostomella ulmi*) in the Province of Quebec, Canada, has necessitated the revision of Quarantine No. 70, extending the quarantine on account of this disease to the Dominion of Canada and other foreign areas north of the United States, including Newfoundland, Labrador, St. Pierre, Miquelon, and islands adjacent thereto [*R.A.M.*, xiv, p. 336; cf. xxvi, p. 576].